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Front Cover
Bill McRae's photograph suggests that the mountain goat is the monarch of precipitous terrain. It is also a unique, delicate, vulnerable creature, whose mountain retreats are threatened by man's encroachment.

Inside Front Cover
This is the season when a wide range of water beckons to Montana's fly-fishing enthusiasts. Shirley Cleary's painting is of Willow Creek, as it runs through the ranch belonging to her husband's family.

Back Cover
Dick Ellis' photograph depicts an example of history brought to life. Experiences such as Bannack Days immerse the visitor in the excitement, sounds, and smells of gold rush days.

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DELICATE MOUNTAIN MONARCHS

by Gayle Joslin

Wisps of fog drift silently among the peaks, evaporating, reforming, moving almost imperceptibly. Behind the mist are glimpses of towering cliffs, jagged rocks, dwarfed and deformed trees—and, in a dark crevice, a vague form which moves forward, then melts into the fog.

Again the form appears and stands motionless on a pinnacle of rock, staring into the blue abyss below. Long shreds of wool hang from its massive humped shoulders. Once again, the clouds move in and swallow this mysterious creature.

* * * * *

THIS MAY HAVE been the scene as Capt. James Cook sailed through the inside passage of British Columbia in the 1700s. He called the creatures "white bears," since there were no known animals other than polar bears which were large, woolly, and white. Other explorers venturing to the western half of the continent labeled them as a kind of sheep.

It is no wonder the mountain goat was misidentified, since it is the only animal of its kind in the world. Its closest relatives are the serow of Japan, the goral of Asia, and the more widely known chamois of the Himalayas. Contrary to popular belief, the mountain goat is not a close relative of the North American pronghorn antelope.

Compared with most other wild ungulates (hoofed mammals) in North America, the range of the mountain goat is limited. From the largest population in British Columbia, distribution extends north into Alaska and the Yukon, east into Alberta, and south into Washington, Idaho, and Montana.

In Montana, the two largest native population segments

Subadult mountain goats (yearlings and 2-year-olds) can be separated from adults by comparing the length of the horns to the length of the ears. The subadult pictured (left photo: Vince Fischer) has horns only one to two inches longer than the ears. In adults, the horns are at least half again as long as the ears. The adult male goat (above inset photo: Harry Engels) lies in a time-honored bedding site. Mountain goats are traditional and will bed in the same spot time and time again over the years. During the rutting season, males often paw the earth and roll in the soft wet dirt. They come away with the soiled coat worn primarily by billies. Mountain goats seem to be able to move anywhere in precipitous terrain (lower inset photo: Allen Wiederrich). Their specialized hooves, with a hard outer shell and a thick spongy interior, help prevent slipping.

The mountain goat's thick, soft coat is shed annually (below photo: Mike Logan). Adult males are the first to complete the process, while females with kids are generally the last. Mountain goats will leave the security of the cliffs to frequent mineral licks to satisfy their desire for salt (right photo: Louis M. Kis). This habit may expose them to dangerous situations, away from escape terrain.

inhabit the Bitterroot Range along the Montana-Idaho border, and what is known as the Northern Continental Divide unit, extending from the Swan Range to the East Front of the Rocky Mountains.

Mountain goats apparently never occupied "island" mountain ranges, even those relatively close to the Continental Divide such as the Belts and Elkhorns. Even the Crazy and Absaroka mountains with their excellent mountain goat habitat did not support goats. Biologists conclude that although goats have daggerlike, lethal horns, their primary defense is steep, rugged terrain. They will not leave the security of the mountains to cross expansive valleys to get to new country.

Mountain goats are staunch creatures of habit, returning to specific areas at certain times of the year throughout their lives. How and when to use various portions of their home range is extremely valuable information passed on from generation to generation through example.

Mountain goats are better adapted than other species at inhabiting harsh, treacherous country, in part because their behavior is placid. A goat cannot afford to dash off in panic at the first sign of danger or it may risk stepping off into oblivion. The easy-going, self-confident nature of mountain goats is often misconstrued as adaptability.

Until recently, goats were buffered from civilization by seemingly impenetrable terrain. Man was not interested in or capable of exploiting this rugged country. Commodity resources were more easily obtained from gentler terrain. But as demand for timber, minerals, and energy increased, technology advanced, and the mountains no longer provided sanctuaries for mountain goats. Recent herd declines in several states and provinces have occurred as timber and mineral activities encroached into mountain goat country.

Roads and projects creeping into its domain, coupled with the goat's predictable, habitual nature, threaten its continued existence in areas undergoing development. Since goats return to an area of traditional use even if human activity is going on nearby, they are exposed to unscrupulous people and the stress associated with something out of the ordinary.

The fact that mountain goats will stand on a cliff and look down on a drilling crew is not an indication of adaptability. Rather, it is typical of the extremely structured, predictable use of their home range. Such structured behavior obviously makes them quite vulnerable.

In the past, little attention was paid to goats because most people believed they were safe in their mountain retreats and because it was difficult to gather information on them. Biologists have only recently begun to understand the unique population ecology of this species. We now realize that mountain goats are, in fact, delicate, vulnerable creatures which merit careful, coordinated management on the part of land and wildlife managers and private companies.

In the game of resource allocation, it is clear that it will be the public's interest in and concern for mountain goats which will ensure that the goats' needs are met when land is parceled out for various purposes. ■

Well-Healed Cutth

• Success of the erythromycin program at the Yellowstone River Trout Hatchery is due largely to the dedication of the hatchery manager, Thurston Dotson, and his crew, and to the guidance of Dr. G.W. Klontz, University of Idaho.—Jim Peterson

* * * * *

THE ENERGY released by a cutthroat trout on the end of a fly line is measured by the fisherman holding the rod. As the fish jumps and surges against the current, its power commands the respect of any angler skillful enough to deceive the cunning and cautious trout into taking a hook. Finally, energy expended, this natural powerhouse is landed, and the victorious sportsman has a chance to view the unblemished beauty of the Yellowstone cutthroat trout.

Montana has many lake and reservoir populations of healthy Yellowstone cutthroat available to fishermen. Most of these are east of the Continental Divide, and many are in the backcountry, accessible only on horseback or by foot. Some of these waters have self-sustaining populations, but most are supplemented from time to time with trout spawned and reared at the Montana Department of Fish, Wildlife and Parks' Yellowstone River Trout Hatchery at Big Timber. Cutthroat trout from the Yellowstone hatchery sustain most of the Yellowstone cutthroat populations in Montana and, in many cases, these trout have turned barren waters into productive fisheries.

The trout often referred to as the Yellowstone cutthroat originated from McBride Lake in Yellowstone National Park. In 1969, the National Park Service allowed the department to collect eggs from spawning cutthroat in McBride Lake to establish the brood stock now held at the Yellowstone River Trout Hatchery. The stock has proved fairly easy to rear

by Jim Peterson

under hatchery conditions, and planted fry and fingerlings perform in the wild like champions.

Even though the stock at the Yellowstone hatchery is now healthy and officially disease-free, this has not always been the case. In 1976, a routine fish health inspection revealed presence of a potentially hazardous bacterial pathogen in the adult brood stock. This bacteria, *Renibacterium salmoninarum,* causes one of the diseases most feared by fish culturists, bacterial kidney disease (BKD). BKD can cause chronic mortality among trout populations. When this disease-causing pathogen has been discovered in hatcheries, the entire fish population has been destroyed, just to get rid of the bacteria and avoid spreading it to other fish or habitats. At the Yellowstone River hatchery, fish exhibited many symptoms of BKD, and as many as 100 adult brood fish were dying every month. Most of these deaths were attributed directly or indirectly to BKD. But the disease that plagued the Yellowstone River hatchery from 1976 until 1979 has turned into a fisheries success story.

BKD is a systemic bacterial infection that results in "popeye" (bulging of the eyes), abdominal swelling, red blotches on body surfaces, and internal lesions. The bacteria accumulate in various organs; BKD lesions in the kidney, observed by fish pathologists, gave the disease its name.

But the bacteria don't necessarily accumulate in the kidney. As a matter of fact, cutthroat at the Yellowstone River hatchery often had concentrations of the bacteria in other organs, even when none could be found in the kidney. The testes of maturing male

roat

Bacterial kidney disease (BKD) is greatly feared in fish hatcheries. Two of the symptoms are "popeye" or bulging of the eyes, and internal lesions (above DFWP photos: Jim Peterson). Because the disease has been controlled at the Yellowstone River Trout Hatchery, a bright and healthy future is ensured for the Yellowstone cutthroat stocking program in Montana (left photo: Gary D. Holmes).

cutthroat were consistently the easiest places to isolate the BKD-causing bacteria.

R. salmoninarum is transmitted from adult spawning fish to eggs. Transmission of disease-causing organisms to the eggs is called "vertical transmission": The bacteria have the potential to infect every egg taken from infected parent fish. This can happen even if that egg or the fish that results from that egg never come in contact with another BKD-causing organism.

Even though egg hatch and fry survival were fairly good at the Yellowstone River hatchery during the outbreak, the fish were carrying *R. salmoninarum* and the potential of spreading the organism to every lake into which the fish were stocked.

To stock healthy fish and avoid spreading disease, biologists had to keep the organism from getting into the eggs. This left two options: (1) to destroy the entire brood stock and start over with new stock, or (2) to clean up the present stock and disinfect the eggs. The first option would have put the hatchery out of production for at least three years; also, BKD or another organism might have arrived with the new stock. Until recently, the only acceptable solution was the first option, but recent results with erythromycin in other states, primarily Idaho, had been encouraging. (An antibiotic, erythromycin is quite effective in controlling bacteria, especially those known as gram-positive, the type that caused BKD.) Most use of erythromycin to control BKD was experimental and the drug was used mostly to control the organism in wild salmon, but we believed it was worth a try with the cutthroat.

The plan involved two steps. First, inject brood fish with erythromycin to control losses among adults. Second, place all eggs collected in an erythromycin bath to try to eliminate vertical transmission of the bacteria.

All brood fish were injected in 1978, several months before spawning, and mortalities dropped within days. The erythromycin injections did not totally eradicate the bacteria, but they limited the number of organisms and controlled their spread. However, after about 30 days, the number of deaths again began to climb, and the fish had to be injected again. Once biologists understood what was going on, they began to inject erythromycin before BKD had a chance to kill fish.

By 1979, every 2- and 3-year-old fish at the hatchery was injected monthly. On the average, 1,200 2-year-old and 700 3-year-old fish were injected each month. Each fish had to be anesthetized and carefully injected with erythromycin. A 1½-inch needle was inserted just under the skin in front of the dorsal fin, and the erythromycin administered with a small, disposable syringe. Less than $20 worth of erythromycin was enough to inject all of the fish each month. However, it took a three-man crew the better part of one day to inoculate each age class.

With brood stock mortality controlled, the next step was to eliminate the organism from the eggs. Clean eggs would not only mean healthy fish to stock, but would eliminate the organism from eggs to be used for future brood stock.

The erythromycin bath for the eggs was a simple procedure. When fish eggs are first taken from the female, they undergo a process called "water hardening" where they absorb water through tiny pores in the shell and swell to a firm, round shape. This process begins immediately after the eggs are taken and can continue for hours. Shortly after fertilization, all eggs collected at the hatchery were placed into a solution containing three parts per million erythromycin. As the eggs water hardened, they absorbed the erythromycin and at the same time were bathed in the erythromycin solution. The idea was to kill the bacteria in or on the egg.

The erythromycin injections and water hardening proved deadly for the bacteria. Incidence of BKD among adult fish declined remarkably. By 1980, biologists could no

continued on page 14

Shrimp and Salmon in Flathead Lake: Time Will Tell

A TOW NET sample collected by Montana Department of Fish, Wildlife and Parks biologists from Flathead Lake on the night of Sept. 9, 1981, rekindled the flame of a biological controversy that has flickered for about 10 years. That sample contained an almost transparent creature barely an inch long. Although this was the first documentation of this secretive crustacean in the West's largest natural lake, the biologists were not particularly surprised.

The opossum shrimp (*Mysis relicta)* is not native to Montana but is native to several deep, cold lakes in the north central and eastern United States and also to many Canadian lakes. Although nearly all of 450 related species dwell exclusively in the oceans, *Mysis* apparently made its way inland during the most recent glacial period and became stranded in numerous lakes across the northern part of the continent as invading ice masses retreated.

As shrimp go, *Mysis* is not large. A mature female usually measures slightly more than one inch long and carries as many as 40 eggs in her brood pouch. The common name—"opossum" shrimp—comes from its habit of brooding the young in a pouch as does the more well-known mammal, the opossum. The eggs are usually laid in the winter and carried in the pouch until spring when the young shrimp are released to fend for themselves. The young mysids take from a few months to two years to mature, depending on the latitude of the lake in which they reside.

Because of some special biological requirements, opossum shrimp are usually found only in deep, cold lakes with low nutrient concentrations and low rates of biological productivity. Such bodies of water are called "oligotrophic," which literally means "few foods." Opossum shrimp shun daylight and prefer cold water (generally less than 55°F) with substantial amounts of dissolved oxygen. The deep waters of many oligotrophic lakes provide ideal *Mysis* habitat.

Many pristine oligotrophic lakes lack the necessary food to support dense populations of rapidly growing sport fishes. This is due to infertile waters, short growing seasons because of low temperatures, and the lack of extensive weed beds typical of more productive lakes. Weed beds provide food, cover, and space for many large invertebrates such as crayfish, leeches, snails, scuds, and various insect larvae—all excellent fish foods. But the steep-walled, troughlike basins of deep oligotrophic lakes make establishment of underwater weed beds and associated invertebrate populations difficult. Deprived of this rich food supply, the fishes in such lakes have two main choices for dinner: either the tiny, free-swimming invertebrates (zooplankton) that live in the water, or each other.

For years, fisheries managers have been frustrated by the inability of deep, oligotrophic lakes to support thriving fisheries and have used two different approaches to solve the

The first opossum shrimp from Flathead Lake were captured in 1981 in a net towed behind the *Dolly Varden,* a research vessel operated by the Department of Fish, Wildlife and Parks.

article and photos by Steve Leathe

problem. The first approach involves fertilization to stimulate the growth of microscopic algae (phytoplankton) which are then fed upon by zooplankton, which in turn become fish food. This has been done successfully in numerous coastal lakes in Alaska and Canada that serve as rearing areas for young sockeye salmon (the seafaring cousins of the kokanee). The main problem with this approach is that it accelerates the natural aging process of lakes and can have undesirable results like appearance of algal "blooms" and oxygen depletion or "stagnation."

The second approach involves introduction of new or "exotic" organisms into lakes to enhance the quality and quantity of the fish food. For decades, this has been a valuable management technique in lakes, although many such introductions have been unsuccessful or have produced unexpected results. Many successful exotic introductions have been forage fish (i.e., various minnow species, alewives, gizzard shad, and even kokanee) which predatory fishes such as trout, bass, and pike feed upon. Introductions of invertebrates such as crayfish and various other freshwater shrimps (including *Mysis)* have also been made.

Mysis has two main attributes that make it a prime candidate for introduction into deep, oligotrophic lakes. First, it is well-adapted to these lakes because it thrives in deep water (200 to 1,000 feet) which is often a "biological desert" as far as fish food is concerned. Second, *Mysis* is much larger and is a more desirable food than are the zooplankton that make up the diet of many fishes in these lakes. Most of the important zooplankton are less than 3 millimeters long (⅛ inch), but *Mysis* sometimes exceeds 25 millimeters (one inch). As a rule of thumb, bigger food means bigger fish, with the notable exceptions of certain filter-feeding plankton eaters such as paddlefish and some species of marine mammals known as whales.

Beginning in the 1950s, opossum shrimp were transplanted into numerous North American and European lakes to benefit a wide variety of cold water game fish. One of the earliest and most successful *Mysis* introductions was made into Kootenay Lake in southern British Columbia during

Adult-sized *Mysis relicta,* or opossum shrimp, are not large—as shrimp go. The two pictured are females carrying yellowish eggs in their brood pouches.

Many tiny, free-swimming invertebrates (zooplankton) inhabit Montana lakes. The two largest animals on the left in this photo are *Daphnia,* the preferred food of kokanee salmon in Flathead Lake.

These shrimplike animals are called amphipods or "scuds," and are only remotely related to the opossum shrimp. Amphipods, common in many lakes and ponds, are excellent fish food.

1949 and 1950. Although the introduction was intended to benefit the large "kamloops" rainbow trout, biologists and anglers alike were pleasantly surprised to find that the kokanee population benefited most from the introduction. Kokanee that matured at less than one pound and 10 to 12 inches long before the introduction were dwarfed by the giant fish (more than six pounds and 20 inches) that became commonplace during the 1960s as the shrimp became established.

Inspired by this success, fisheries managers throughout the western United States initiated an extensive *Mysis* transplanting program to benefit trout and salmon populations. Between 1968 and 1975, opossum shrimp from Waterton Lake in Alberta were introduced by department biologists into 13 lakes in northwestern Montana, including three (Ashley, Whitefish, and Swan) in the Flathead drainage. The mysids found in 1981 were probably downstream migrants from populations that became established in these lakes.

Unfortunately, the glowing success story of the Kootenay Lake experiment has not been repeated in most of the western United States lakes that received *Mysis.* Researchers sounded the first alarm in the mid-1970s when they reported an unusual event in Lake Tahoe: the sudden disappearance of several zooplankton species. This uncommon occurrence seemed to be correlated with increases in the lake's kokanee population as well as establishment of a high-density *Mysis* population after a transplant made five to seven years before. Apparently, the kokanee and *Mysis* both contributed to elimination of a particularly important type of zooplankton known as *Daphnia,* a preferred food item of kokanee in many lakes. Lake Tahoe's kokanee declined in numbers and size following the *Daphnia* disappearance.

Declining kokanee populations following establishment of transplanted mysids have been documented in other lakes as well. Mysids introduced into Priest Lake, Idaho, took about seven years to peak, in 1972 and 1973. Kokanee apparently "took a shine" to the new resident, and a fisherman caught the world record (6 lbs., 9 ozs.) in 1975. The benefit was short-lived, however, as the lake's kokanee population declined dramatically in 1976 and has not rebounded. The situation at Idaho's Pend Oreille Lake is similar, although far fewer record-class kokanee have been taken and the population decline has been gradual.

The *Mysis* controversy came to Montana in fall 1976 when a department crew taking spawn from koka-

nee was able to capture only a few small fish from a shoreline area of Whitefish Lake that had traditionally accommodated many spawners. Fishermen's empty creels also indicated that the Whitefish Lake kokanee had practically disappeared a year or two after *Mysis* became firmly established following a 1968 plant.

Prompted by these disturbing events, researchers throughout the West began searching for answers to the *Mysis* question. Biologists were surprised to find that in most of these "problem" lakes, declining kokanee populations were not paralleled by increases in the average size of mature fish. This is unusual, since kokanee growth depends on density—individual fish grow larger when population densities are low because competition for food is less intense. Based on this finding, biologists concluded some other agent was reducing the kokanee food supply. Subsequent studies have shown this "other agent" could be *Mysis*.

Many (but not all) biologists believe the unique biology of *Mysis* itself accounts for the problems encountered in some of the kokanee lakes. Since these shrimp tolerate only very low light, they spend their days in the comfortable darkness of very deep water. Daytime observations from a submarine in Lake Michigan revealed few mysids in waters shallower than 300 feet. The shrimp presumably feed on decomposing organic material that rains down into the depths from the more productive surface waters. In deep water, *Mysis* easily falls prey to lake trout and various whitefish species. However, the shrimp are not particularly vulnerable to kokanee since the salmon spend most of the day near the surface (50 to 100 feet down) where they feed almost exclusively on *Daphnia* and other small zooplankton. Studies on Flathead Lake have shown that each kokanee eats 7,000 to 14,000 *Daphnia* per day during the summer.

With darkness, kokanee quit feeding because they require adequate light to visually locate their tiny prey. During the night, opossum shrimp make astounding vertical migrations and move into the surface waters where they also feed on *Daphnia* and other zooplankton and phytoplankton species before retiring to deeper water before dawn. An opossum shrimp may consume up to 15 to 20 *Daphnia* per night.

Mysis make nocturnal ascents and descents of 300 feet in just an hour or two. Such movements are among the most extensive and rapid known for freshwater invertebrates. This adaptation enables them to utilize an abundant food supply, while minimizing danger from predators. It is not an advantage to the kokanee, however, since the shrimp compete for zooplankton, while remaining mostly unavailable to kokanee.

Although the situation sounds grim, don't sell the cowbells and hang up the trolling rod yet, because the argument against mysid introductions into kokanee lakes is by no means over. Kokanee populations have continued to thrive in Ashley and Swan lakes in northwestern Montana in spite of established *Mysis* populations. Kootenay Lake continues to produce jumbo kokanee, although these fish are produced only in the shallow West Arm of the lake. Mysids are apparently swept into the West Arm by strong upwelling currents from the deep waters of the main lake. Once in this bay, the hapless shrimp cannot retreat to their deep water refuge and they become easy prey for foraging kokanee. Although showing no increases in growth, kokanee populations have remained stable in the deep water areas in the main body of Kootenay Lake after mysids became established.

The impacts of opossum shrimp on zooplankton populations may well depend on lake productivity and *Mysis* density. Lake Tahoe is an extreme case because it is exceedingly unproductive or "ultra-oligotrophic" and supports a sparse zooplankton population. In this case, the combination of kokanee and mysid predation likely overloaded the system and resulted in near-extinction of prime kokanee foods.

Pend Oreille Lake researchers have concluded that *Mysis* causes zooplankton depletions in kokanee feeding zones only during spring and early summer when lake temperatures are cool enough for the shrimp to invade the surface waters. However, spring is a critical period for recently hatched kokanee fry. The mysid-induced absence of essential foods during the spring might result in excessive fry mortality and subsequent reductions in kokanee populations.

Limited information suggests that a similar situation may have occurred in Whitefish Lake, although the theory has not been scientifically proved. To counteract the problem, kokanee fry raised in hatcheries are not released into the lake until midsummer when warm lake surface temperatures create a *Mysis*-free haven where prime kokanee foods like *Daphnia* flourish. This approach seems to be working in Pend Oreille Lake, although it is too early to tell in Whitefish Lake.

Because *Mysis* impacts vary from lake to lake, it is difficult to predict what will happen in Flathead Lake. *Mysis* will probably establish itself; however, the process will probably take five or more years because of the lake's large size and the relatively low mysid reproductive rate. At present, *Mysis* is exceedingly rare in Flathead Lake and could not possibly be responsible for recent kokanee declines, which have been linked to effects of dam operations on upstream spawning areas. If *Mysis* becomes established at the relatively low densities found in Ashley and Swan Lakes, the shrimp could benefit lake trout, bull trout, whitefish, and maybe even kokanee in certain upwelling areas. However, problems could result if established densities approach those documented in Whitefish and Pend Oreille lakes (which in some years have ranged from 10 to 20 times higher than the Swan and Ashley populations). The factors that control mysid density in lakes are not yet determined and need investigation.

Excellent information on all aspects of the biology of the Flathead Lake fish population has been gathered during an ongoing department project begun in 1966, and by recent studies funded by the Environmental Protection Agency (part of the Flathead River Basin Impact Study) and the Bonneville Power Administration. Monitoring of kokanee, zooplankton, and *Mysis* will continue, as will debate over the issue. Risk is always involved when an exotic species is introduced into a new system. All too often, the ultimate factor determining success or failure of many of these introductions is time. And, as the saying goes, time will tell. ■

The Catchall

Become A Big Tree Hunter

For the past few years, foresters, loggers, ranchers, doctors, lawyers, businessmen, and just plain folks have gone about their activities in Montana's forests with one eye peeled for trees of exceptional size and beauty. Although diverse in occupation and interests, these people share a common goal: finding, preserving, and giving recognition to Montana's biggest trees.

They have shared friendly competition and the thrill of searching for—and sometimes finding—a hoary giant of a tree that makes the current champion look like a sapling. They have also shared a deep sense of appreciation and love for the forests that protect watersheds, provide habitat for wildlife and jobs for people, heat homes, and make Montana a beautiful place in which to live.

The search for Montana's champion trees is sponsored by the Montana Tree Farm Committee, the administering organization of the American Tree Farm System in Montana. You don't have to be a forester or tree farmer, however, to hunt for big trees. The search to ensure that our biggest trees are found and protected is open to everyone.

The nominating process is simple. Any tree that grows naturally in Montana qualifies as a candidate. All that's needed to nominate a tree is: (1) correct species identification, (2) accurate measurement of circumference in feet and inches, taken 4½ feet above the ground, (3) total height in feet, (4) average crown spread in feet, and (5) a description of the tree's exact location. Send this information to the address listed at the end of this article.

The Tree Farm Committee also has nomination forms which describe the required measurements in more detail. But nominations written on notebook paper, napkins, envelopes, or whatever is handy are acceptable, as long as the information is accurate and legible. Tree Farm Committee foresters will verify measurements on the ground if the tree is big enough to qualify as a champion or to challenge a current champion.

The following register lists the biggest native trees found in Montana to date. At least one has already qualified for national champion status. Nevertheless, the program is young and even bigger trees undoubtedly stand undiscovered in Montana's mountains and valleys. If you love and appreciate trees, or simply have a hankering to see your name in the record book, the Tree Farm Committee urges you to become a big tree hunter. Your participation will help us find and preserve one of Montana's finest treasures.

For more information, contact: Wayne W. Ludeman, Inland Forest Resource Council, 111 E. Broadway, Room 320; Missoula, MT 59802.

BLACK COTTONWOOD, *Populus trichocarpa*
Circumference: 19' 1"
Height: 132'
Crown Spread: 70'
Owned by: Mr. and Mrs. Ray Tangen, Libby
Nominated by: Russ Hudson, Libby
(National Champion: Circ. = 30' 2", Ht. = 147', Crown = 97')

PLAINS COTTONWOOD, *Populus deltoides*
Circumference: 25'
Height: 80'
Crown Spread: 86'
Owned by: Mel Bakken, Sidney
Nominated by: Myron L. Saylor, Sidney
(National Champion: Circ. = 36' Ht. = 105', Crown = 93')

DOUGLAS-FIR, *Pseudotsuga menziesii* var. *glauca*
Circumference: 16' 9"
Height: 158'
Crown Spread: 38'
Owned by: U.S. Forest Service, Flathead National Forest
Nominated by: Douglas Maryott and Dev Hill, Hungry Horse
(National Champion: Circ. = 17' 7", Ht. = 156', Crown = 44')

ENGELMANN SPRUCE, *Picea engelmannii*
Circumference: 13' 7"
Height: 203'
Crown Spread: 35'
Owned by: Champion Timberlands, Milltown
Nominated by: Pleasant Valley District
(National Champion: Circ. = 24' 2", Ht. = 179', Crown = 35')

GRAND FIR, *Abies grandis*
Circumference: 15' 6"
Height: 115'
Crown Spread: 38'
Owned by: St. Regis Paper Co., Libby
Nominated by: Barry Dexter, Libby
(National Champion: Circ. = 15' 6", Ht. = 231', Crown = 46')

LIMBER PINE, *Pinus flexilis*
Circumference: 6' 6"
Height: 76'
Crown Spread: 23'
Owned by: Gene Walsh, Cameron
Nominated by: Fred Staedler, Anaconda
(National Champion: Circ. = 29' 5", Ht. = 43', Crown = 36')

LODGEPOLE PINE, *Pinus contorta* var. *latifolia*
Circumference: 8' 3"
Height: 107'
Crown Spread: 28'
Owned by: Flathead National Forest
Nominated by: Dan Smiley, Columbia Falls
(National Champion: None listed by American Forestry Assn.)

PONDEROSA PINE, *Pinus ponderosa* var. *scopulorum*
Circumference: 20' 1"
Height: 194'
Crown Spread: 64'
Owned by: Lolo National Forest
Nominated by: Don Wood, Victor, and Don Campbell, Milltown
(National Champion: None listed by American Forestry Assn.)

QUAKING ASPEN, *Populus tremuloides*
Circumference: 8' 3"
Height: 104'
Crown Spread: 19'
Owned by: Champion Timberlands, Milltown
Nominated by: Lincoln District
(National Champion: Circ. = 11' 8", Ht. = 86', Crown = 37')

SUBALPINE FIR, *Abies lasiocarpa*
Circumference: 6' 10"
Height: 140'
Crown Spread: 18'
Owned by: Champion Timberlands, Milltown
Nominated by: Pleasant Valley District
(National Champion: Circ. = 21' 1", Ht. = 129', Crown = 22')

WESTERN LARCH, *Larix occidentalis*
Circumference: 19' 6"
Height: 175'
Crown Spread: 37'
Owned by: St. Regis Paper Co., Libby
Nominated by: E.L. Yahvah, Libby
(This tree is the current National Champion.)

WESTERN HEMLOCK, *Tsuga heterophylla*
Circumference: 6' 1"
Height: 99'
Crown Spread: 30'
Owned by: Champion Timberlands, Milltown
Nominated by: Pleasant Valley District
(National Champion: Circ. = 27' 4", Ht. = 164', Crown = 62')

WESTERN RED CEDAR, *Thuja plicata*
Circumference: 33' 3"
Height: 149'
Crown Spread: 26'
Owned by: St. Regis Paper Co., Libby
Nominated by: Bruce Miehe, Libby
(National Champion: Circ. = 61', Ht. = 178', Crown = 54')

WESTERN WHITE PINE, *Pinus monticola*
Circumference: 13' 10"
Height: 190'
Crown Spread: 17'
Owned by: Flathead National Forest
Nominated by: Don Krogstad, Bigfork, and Ed Hula, Columbia Falls
(National Champion: Circ. = 20' 7", Ht. = 239', Crown = 40')

PACIFIC YEW, *Taxus brevifolia*
Circumference: 3'
Height: 23'
Crown Spread: 18'
Owned by: State of Montana
Nominated by: Tom Vars and Bob Andreozzi, Olney
(National Champion: Circ. = 14' 8", Ht. = 60', Crown = 57')

SPECIES WITH NO NOMINATION TO DATE

White spruce, *Picea glauca*
Narrowleaf cottonwood, *Populus angustifolia*
American elm, *Ulmus americana*
Bur oak, *Quercus macrocarpa*
Balsam poplar, *Populus balsamifera*
Green ash, *Fraxinus pennsylvanica*
Box elder, *Acer negundo*
Northwestern paper birch, *Betula papyrifera* var. *subcordata*
Water birch, *Betula occidentalis*
Western paper birch, *Betula papyrifera* var. *commutata*
Bitter cherry, *Prunus emarginata*
Western chokecherry, *Prunus virginiana* var. *melanocarpa*
Pin cherry, *Prunus pennsylvanica*
American plum, *Prunus americana*
Sitka alder, *Alnus sinuata*
Mountain thinleaf alder, *Alnus tenuifolia*
Common juniper, *Juniperus communis*
Rocky Mountain juniper, *Juniperus scopulorum*
Utah juniper, *Juniperus osteosperma*
Canyon maple, *Acer grandidentatum*
Rocky Mountain maple, *Acer glabrum* Torr. var. *glabrum*
Buckthorn, *Rhamnus purshiana*
Curlleaf cercocarpus, *Cercocarpus ledifolius*
Alderleaf cercocarpus, *Cercocarpus montanus*
Red-osier dogwood, *Cornus stolonifera*
Elderberry, *Sambucus coerulea*
Black hawthorn, *Crataegus douglasii*
Columbia hawthorn, *Crataegus columbiana*
Fleshy hawthorn, *Crataegus succulenta*
Fireberry hawthorn, *Crataegus chrysocarpa*
Saskatoon serviceberry, *Amelanchier alnifolia*
Utah serviceberry, *Amelanchier utahensis*
Willows, *Salix* spp.

Albino Black Bear

Kalispell archer Brad Borden legally harvested this albino black bear with an arrow on May 14. He spotted the bear in timbered country near Tally Lake, about 22 miles northwest of Kalispell. This is the first case of albinism in black bear that the

Department of Fish, Wildlife and Parks has documented; however, other albino bear have apparently been seen in Montana.

The female bear weighed between 110 and 130 pounds, was 49 inches from nose to tail, and appeared to have been in excellent condition. The bear had no sign of pigmentation. The fur was a yellowish-white, and the skin pinkish-white; the claws were about the same color as human fingernails.

Borden said he plans to have the trophy stuffed, encased in glass, and displayed somewhere in the Flathead Valley so that people will get a chance to see the unusual "ghost bear" (DFWP photo: Mike Aderhold).

Book Reviews

MONTANA WILDLIFE, by Robert C. Gildart with Jan Wassink, Montana Magazine, Inc., P.O. Box 5630; Helena, MT 59604, 1982, 128 pages, $12.95, soft cover.

The third in the Montana Geographic Series published by Montana Magazine, Inc., "Montana Wildlife" is a handsome compendium of Montana's diverse fauna. Lavishly illustrated with color photographs by several of Montana's finest wildlife photographers, the book covers everything from fish, reptiles, and amphibians to birds and mammals.

It also includes chapters on the history of wildlife in Montana, wildlife management, and observing and photographing wildlife. The last two sections concentrate on seasonal phenomena, such as bird migration and the courtship ceremonies of the grouse, and on Montana's rare and endangered species.

The Montana Geographic Series is devoted to describing the widely varied geographical features of Montana. Previous volumes include "Montana Mountain Ranges" and "Eastern Montana."

COOKING THE SPORTSMAN'S HARVEST II, South Dakota Department of Game, Fish and Parks, 445 E. Capitol; Pierre, SD 57501, 120 pages, $3, soft cover.

If you have ever wanted to prepare pheasant tetrazzini or mix up a batch of your own deer sausage, there's a cookbook that tells you how. "Cooking the Sportsman's Harvest II," published by the South Dakota Department of Game, Fish and Parks, is a sequel to the out-of-print first volume published in 1974. The second has a variety of recipes for many species of game and fish; some are easy to fix and others will fully test your culinary skills.

Of particular interest are sections on canning and pickling fish, smoking fish and game, making your own sausage and salami, and preparing jerky. It also contains a section devoted to marinades, sauces, and batters.

The only criticism of "Harvest II" is that it lacks the handy spiral binding of "Harvest I." To order, send $3 to the address above.

THE MONTANANS' FISHING GUIDE. Volume 1 (310 pages), revised and updated by Dale A. Burk. Volume 2 (307 pages), revised and updated by James A. Derleth, Mountain Press Publishing Co.; Missoula, MT 59801, 1982, $9.95 each.

The fourth edition of "The Montanans' Fishing Guide" continues the two-volume format, but with new authors: Dale A. Burk for Volume 1—"Montana Waters West of the Continental Divide," and James A. Derleth for Volume 2—"Waters East of the Continental Divide." Both build on the foundation established by R.L. "Dick" Konizeski, who conceived and wrote the original guide in the 1960s.

These guides will help you choose waters for the type of fishing you enjoy. Every stream, lake, and reservoir worthy of mention is included. The entry for each includes its name and a description including size, directions on how to get there, and what to expect in the way of fish. The style is concise and fun to read.

Recognizing that changes do occur, these are as reliable as guides can be. They are the product of innumerable contacts with Department of Fish, Wildlife and

Biologist Gerry Brown (left, in uniform) and assistant Mike Madel are working with a 295-pound male black bear on the east side of the Cabinet Mountains near Libby. The bear was trapped and tagged as part of a $50,000 study funded by U.S. Borax and Chemical Corp. The study will evaluate and minimize the impacts of mineral exploration and development on bears, grizzlies as well as blacks. The study will also determine the distribution and habitats of these animals (DFWP photo: Mike Aderhold).

Parks, U.S. Forest Service, and Soil Conservation Service personnel, sporting goods store owners, guides, outfitters, and expert fishermen. Our department's files and fishery data base were gleaned and thousands of maps and photos were studied.

Each major drainage or section in the two volumes has a new or updated lead article prepared by a knowledgeable fisheries biologist or local authority. Each volume has color reproductions of Ron Jenkins' paintings of the 21 most prominent Montana sport fishes, plus a number of black and white photos of fish, fishing, and wildlife in general. The western guide contains 62 lake-contour maps from department files, and a special section on waters in Glacier National Park. The eastern guide contains maps showing the location of ranch ponds in Valley, Phillips, and Hill counties.

These revisions are timely, as innumerable changes have occurred in access routes, the habitat for fishes, and species and sizes present in individual waters.

The guides are well worth the price. I recommend them for anyone wanting to learn about and enjoy the tremendous fishing Montana offers.—*George Holton, assistant administrator, Fisheries Division*

Almost 100 children from as far away as Moon Creek (near Miles City) and Sunburst crowded the Governor's Reception Room on April 7 to watch as Gov. Ted Schwinden—appropriately attired in a bear cap—signed into law a bill naming the grizzly bear Montana's state animal. The children had participated in a campaign initiated by Secretary of State Jim Waltermire (in foreground) to teach students about voting and the legislative process by involving them in selection of Montana's state animal. Sen. Larry Tveit (R-Fairview, to Gov. Schwinden's right) sponsored the bill that named the grizzly, which had been the student's 2-1 choice over the elk (photo: courtesy Gene Fischer, Helena Independent Record).

Well-Healed Cutthroat
continued

longer detect BKD. Egg and fry survival improved, and some of those eggs water hardened in erythromycin are now the heart of the hatchery brood stock.

Recent research conducted by the U.S. Fish and Wildlife Service indicates that although the erythromycin water bath helps limit the bacteria, injections to brood fish alone may inhibit vertical transmission of the organism. Since BKD can no longer be found in the cutthroat, no further injections are planned at the Yellowstone hatchery. However, erythromycin water hardening will continue as a routine precaution. Nearly a million cutthroat eggs are taken each year at the Yellowstone River hatchery, and all of these can be bathed in erythromycin for only pennies.

Fish that die at the hatchery now are examined for *R. salmoninarum*. None have been found since March 1980. In addition, routine samples are collected annually from a representative group of adult fish, and no bacteria were found in 1980, 1981, 1982, or 1983.

Success of the erythromycin program at the Yellowstone River Trout Hatchery has given new life to the Yellowstone cutthroat brood program in Montana. This hatchery, nestled along the bank of the Yellowstone on the outskirts of Big Timber, is one of Montana's smallest. Yet, because of the cutthroat brood stock it maintains, it is one of the most important.

Nobody can say for certain if BKD-causing bacteria are totally eliminated from the hatchery. But if they are hiding in a corner somewhere, they are not detectable and no fish are dying from them.

The Yellowstone cutthroat (or McBride cutthroat, as it is often called now) has earned the respect of many fishermen. It has a place in the hearts of those who have spent an afternoon fishing the often pristine waters these trout call home. For now at least, the disease control program at the Yellowstone River Trout Hatchery has insured a bright future for the Yellowstone cutthroat stocking program, and a continuing challenge to those anglers who enjoy catching them. ■

"Fire Canoes" on the Big Muddy

by Ken Walcheck

SILENT GALLERIES of eroded shale and sandstone formations roll to the horizon and sun-washed colors play on the water that runs in a ribbon to the open sky. The whisper of the wind and the rustle of cottonwood leaves are pierced by a sudden blast of a shrill whistle. Rounding a bend in the river, a steamboat comes into view. With smoke belching from twin stacks and spray cascading from a flashing paddlewheel, the shallow-

drafted craft plows through the murky water.

It was quite a sight. Twenty-five hundred miles up the Missouri, paddlewheelers plied their way into history and fired a national spirit of adventure. Mile after winding mile up the tortuous, shifting, and meandering Missouri, through a country subject to tornadoes, violent thunderstorms, fierce gales, irritating clouds

In the 1860s, river transportation offered the safest, fastest, and most comfortable way for large amounts of freight and numerous fortune seekers to enter the Montana Territory. The steamer above is pictured near Citadel Rock on the Missouri and is probably bound for Fort Benton.

of mosquitoes, and unpredictable and sometimes hostile Indians, the "fire canoes" ran the gauntlet from St. Louis to Fort Benton.

That the Big Muddy was a moody, capricious river to steamboat traffic was well-appreciated by early writers. Newspaper humorist George Fitch described it as "a river that plays hide-and-seek with you today, and tomorrow follows you around like a pet dog with a dynamite cracker tied to its tail." A Sioux City Register reporter added a further note: "Of all the variable things in creation, the most certain are the action of a jury, the same of a woman's mind, and the condition of the Missouri River."

Even Meriwether Lewis penned his concern about the river. "The difficulties which oppose themselves to the navigation of this immense river," he wrote from his 1805 winter camp at Fort Mandan (in what is now North Dakota), "arise from the rapidity of its current, its falling banks, sandbars, and timber which remains wholly or partially concealed in its bed...to these we may add a fifth and not very much less inconsiderable difficulty, the turbid quality of the water, which renders it impossible to discover any obstruction even to the depth of a single inch." Lewis would have been astonished to know that despite the amalgam of trials, approximately 700 different steamboats plied the Missouri between 1819 and the disappearance of paddlewheel traffic after 1900.

On more than one occasion, I have rested my back against a sturdy cottonwood on the banks of the Missouri, thinking what it must have been like to travel from St. Louis to Fort Benton aboard a steamer. If the setting is proper and the mood right, I can close my eyes and smell the smoke and hear the whistle: "Step aboard Pilgrim! I've got plenty of steam in my boilers to take you to a land that's as shiny as a $20 gold piece. I'll run you through a buckskin country so vast, so wild, so lovely and rich, and with a sky so blue, it'll make your head swim. It's all yours for the takin'."

Steamboats mirrored the robust and unpredictable frontiers which lured people to whom risk and hardship were a way of life. During the rough, romantic era of riverboating, steamboats added page after page of history that became interwoven with many significant events in the region stretching from St. Louis west, and north to Canada.

Before the steamboat era, not very many folks—if any—had the luxury of riding all the way up the Big Muddy. They poled, paddled, pulled, and sailed part of the way, but most of the distance they waded—slipping and falling as they lurched along treacherous banks, trying to tow their mackinaws or keelboats upstream. The wind blew, usually from the wrong direction, or it didn't blow at all, so sails were of little help in bucking an impetuous current. It was a life reserved only for the hardiest.

About 1811, that smoke-belching contraption known as the steamboat joined the river flotilla. Even though the new kid on the river had the strength of a bull buffalo and the endurance of a smart mule, it still was

victimized by a catalog of woes. It was buried by sandbars, ravaged by fire, pulverized by ice, skewered by snags, ripped to kindling by powerful winds, devoured by rapids, and blown to bits by violent boiler explosions.

Drawing six feet of water, the first steamboats were underpowered and limited to the deeper lower river. The Mississippi side-wheeler appeared on the Missouri in 1819. But it was not until 1859 that a serviceable steamboat—the stern-wheeler—arrived on the Missouri. The shallow-drafted craft, with reduced superstructure to counter high winds, could carry 300 to 400 tons of freight and 200 to 300 passengers while drawing less than three feet of water.

The discovery of gold in Montana at Grasshopper and Gold creeks, and Confederate, Alder, and Last Chance gulches in the early 1860s, construction of the Mullan Road from Fort Benton to Fort Walla Walla in Washington, and the ensuing extension of steamboat travel to Fort Benton served as catalysts in the rapid development of the Montana Territory. In the 1860s, Fort Benton was the focal point for commercial expansion. This bustling, ramshackle boomtown, so well-described by the editors in the introductory chapter of Paul F. Sharp's "Whoop-Up Country," was destined to become a lodestone of regional history:

> Perched at the head of navigation, Fort Benton was an unusual frontier town. "Chicago of the Plains" the village proudly called itself—"the door through which the country to the east, west and north of it was entered." Eastern pilgrims always watched with mingled emotions the motley crowds that greeted their boat as it nosed into the wharf, for there stood merchants in high-collared broadcloth coats, French-Canadian and Creole river men wearing bright-colored sashes, tough trappers and traders heavily armed and wearing buckskin, bullwhackers and muleskinners in coarse, rough denim, and, in the background, red savages wearing leggings and blankets.
>
> This diverse collection of humanity was eloquent testimony that Fort Benton was the most cosmopolitan city on the plains....Immigrants from nearly every nation of Europe visited it, as well as wanderers from China and Negroes from the Deep South.
>
> The human stream pouring through Fort Benton was a constant reminder that the northern plains were the commercial hinterland of the proud little river town. With justifiable enthusiasm, the local editor could claim that his little village "commands the traffic of the country, holds the key to the business houses of the Territory... [is the] transportation center of Montana."

The first steamboat to travel the Missouri River to Fort Benton was the light draft *Chippewa* which churned its way up the Missouri in 1860. The *Chippewa* opened the door to big business in Montana until the iron horse plodded far enough west to compete. River transportation offered the safest, fastest, and most comfortable way for large amounts of freight and numerous fortune seekers to enter the territory. Big business it was, for entrepreneurs. In 1863, approximately $8 million, mostly in minerals, floated down the Missouri in steamers bound for St. Louis and elsewhere. Five-sixths of Montana's wealth reportedly left the region via the Missouri River in the 1860s.

The steamer *Montana* was one of the largest ever to visit Fort Benton. It brought in 600 tons of freight at one time. The *Montana* was wrecked near St. Charles Bridge (photo: courtesy Montana Historical Society).

With the bonanza reachable, the

enterprising merchants of St. Louis and other ports lost no time in constructing vessels which could successfully navigate the Missouri and Yellowstone rivers. Despite the eccentricity of the Missouri and its hazards, the steamboat men kept heading upstream. Of 46 vessels bound for Fort Benton in 1867, 15 didn't complete the trip. Four were sunk or grounded, their bones left for the river to reclaim. The risks, however, were worth taking and the steamer that beat the odds usually made more money on one round trip than the vessel was worth. The *Peter Balen* cleared $65,000 on her first trip to Fort Benton in 1866—a small fortune at this time. Reported profits of other steamers in 1866 were: the *W.J. Lewis*, $40,000; the *Cora*, $50,000, and the *Deer Lodge*, $45,000.

The log of any steamer is replete with descriptions of hardship and danger. Running aground was sometimes an hourly occurrence. Once aground, it was up to the experience, ingenuity, and industry of the captain and the crew to free her. With a spoon-shaped bow, some vessels could slide up a sandbar and, with a little luck, back off. In shallow passages where paddles threshed mud and air, the craft would be "sparred" or "walked" over the obstruction. For this maneuver, two huge poles or spars were lowered to the bottom of the river at a 45-degree angle. Cables were then attached to a capstan (a powered drum mounted on a vertical axle) powered by a steam engine, and the boat was "grasshoppered" ahead, one step at a time, until it finally floated free. If too swift for the engines, rapids were navigated by planting a "deadman" (a heavy timber buried in the ground), fastening a hawser (large rope) to it, and "inching" ahead while the capstan pulled on the hawser.

During low water, part of the cargo from heavily laden steamers had to be unloaded. The steamer then proceeded to its destination, unloaded, and returned for the cargo left at the rapids. In the parlance of the river, this was "double-tripping." In 1869, a year of extremely low flows, 18 of the 24 steamers which got through had to double-trip from Dauphin's Rapids in order to reach Benton.

Steamboats had insatiable appetites for wood. The need for wood was always critical, since a typical steamer ate up 30 cords a day—a supply that half filled the boiler deck. The log of the steamer *Henry M. Shreve* provides some information on fuel consumption and costs: On her 67-day journey from St. Louis to Fort Benton in 1869, 1,051 cords of wood (mostly cottonwood) were purchased for $6,048.70. Prices ranged from $2.50 to $15 per cord, and averaged $5.75 per cord. The *Shreve* stopped 71 times to take on wood. When wood was scarce or Indians threatened, crews wrested cottonwood snags from the water and driftwood from sandbars.

Indians made life for the wood hawkers, who supplied the steamers with fuel, particularly hazardous. Historian Raymond Welty estimated that between 1867 and 1869, nearly one-third of the woodcutters operating along the banks of the Missouri were killed.

Unfortunately, no reporters speculated on the ecological impact of the ax on the cottonwood groves and the wildlife utilizing them. Some simple mathematics illuminates the dimension of timber "mining" in the streamside (riparian) zone. First, one has to remember that the Missouri was no isolated highway. Approximately 400 steamboat arrivals were recorded at Fort Benton between 1860 and 1888. During 1867, the peak of steamer traffic, 39 stern-wheelers were on the river between the mouth of the Yellowstone and Fort Benton. If one assumes the average travel time from the mouth of the Yellowstone to Fort Benton was about 23 days, and 30 cords (a stack of wood 4 x 4 x 8 feet) were utilized per day, 400 steamers smoked up about 276,000 cords (downstream usage not calculated). Stretched end to end in a straight line, 276,000 cords would run 418 miles or fill a gargantuan woodbin holding 35,228,000 cubic feet—enough wood to build 26,663 modern three-bedroom houses.

Nor do the ship's logs bulge with biological information. No Meriwether Lewises rode the steamers, recording reliable descriptions of wildlife and plants in the Missouri River drainage. This was most unfortunate since there was probably no place on the continent as rich in both animal and bird life as the Missouri River bottomlands. Artist-naturalist John James Audubon was on the scene, but he traveled by steamer only to Fort Union, just above the mouth of the Yellowstone.

If one takes the time to peruse the wealth of literature on steamboats, it soon becomes clear this was an era of exploitation, greed, and an expectancy that the wildlife resource was inexhaustible. In some of the eastern states, there was an awakening realization that the nation's natural resources were finite. But this realization had not yet dawned in the Big Sky Country and other points west.

A lust for adventure and excitement were also hallmarks of the steamboat traveler. This is exemplified by those steamer passengers who recorded their impressions when game was sighted. Their diaries reflected the West as the men and women who crossed the prairies on the waters of the Missouri saw it. As reported in John Napton's "My Trip on the *Imperial* in 1867," the sport and glory of a buffalo shoot from the deck of a steamer was an exciting event. Somewhere west of the mouth of the Yellowstone, the young prospector wrote:

> We were now evidently in the buffalo country and Indian country also. Soon afterwards we saw another big band of buffalo—thousands of them—crossing the river, going south and the boat was headed for them and struck about the middle of the herd. Then the wheel was reversed, in order to hold the boat amongst them, and everybody commenced shooting with pistol, shotgun or rifle....Three or four cows were hauled aboard, and this ended the slaughter.

With the same spirit, Daniel H. Weston, passenger on the *Lillie Martin,* recorded his reflections of a hunt:

> We all rushed to the hurricane roof with our rifles—the cry of a bear in sight being raised—but we found it was a wolf and soon many wolves appeared. The rifles cracked fast but brought none down. Pretty soon two antelope were seen swimming the river just ahead. They were allowed to land on an open island which the boat was "hugging" and such a fusillade is seldom heard except in war. One was shot and the other took to the river again where he was also shot. I fired seven

times but am in great doubt if I hit either.

In the afternoon five others and myself rowed across the river in the yaw to hunt for antelope, as we saw a herd from the steamer. Traveled far over prairie to high bluffs, seeing many large birds but no antelope till returning [when] eight to ten leaped across our path. We were so surprised we fired wildly while they were swiftly flying in a whirl of fleetness. I fired five times but we got none. They looked most beautiful, lead [sic] off by a fine buck with lofty head and stately tread. We rowed back in a high wind and I was thoroughly tired but glad of the tramp and exercise.

One might wonder why there were so few mentions of commonplace animals in wildlife documentations of the era. With some exceptions, most people—unless they are specially trained or have an avid interest in a discipline—do not write about everyday things. The larger animals, particularly elk and buffalo, were "everyday things"—they were not only abundant, but were also a chief source of food and clothing.

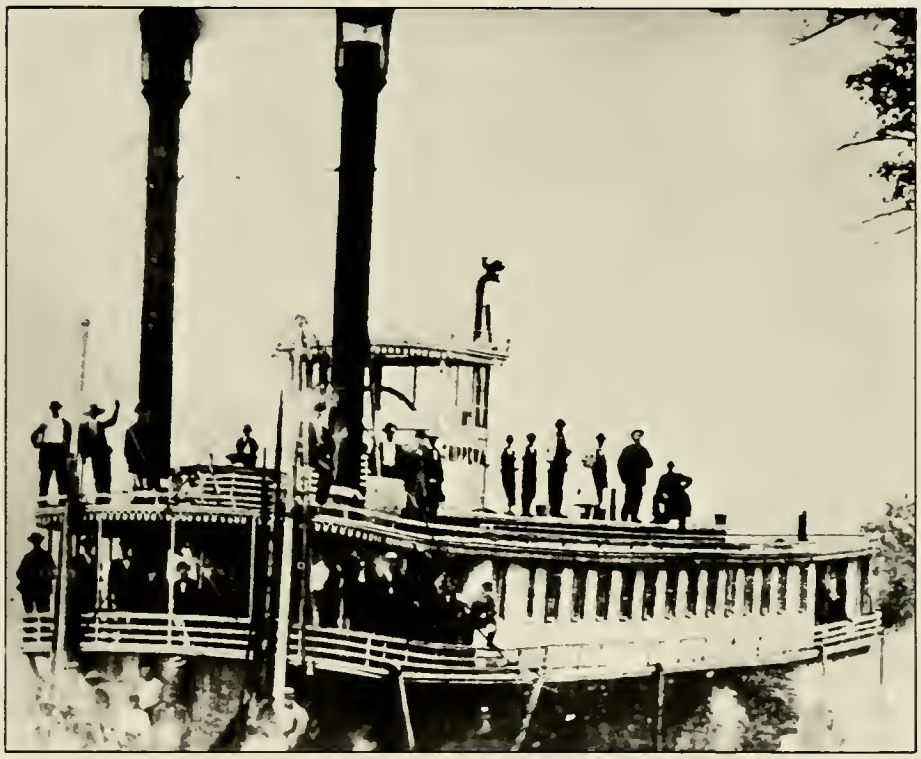
Information on fishes in the Missouri is also lacking in the steamboat passengers' journals. Presumably, people fished, but few bothered to record their experiences or catches. Mrs. Wilbur Fisk Sanders was one exception. Traveling on the *Abeona* to Fort Benton, she wrote: "Mike caught a swordfish [upstream from the Milk River] of 25 pounds. Mr. Sanders shot it and Mike jumped in and caught it. Its mouth is as large as Jimmie's head." One can speculate that the fish was a paddlefish, probably one of the first caught in Montana.

As an ironical footnote, the steamboat played a supporting role in destruction of the great migrating buffalo herds—one of the most brutal and wasteful chapters in the history of America's wildlife. The early steamers transported scores of buffalo hunters to jumping-off points, and later transported tons of hides and meat from the slain buffalo downstream. In 1878, buffalo robes were still an important and stable commodity. Seventy-two thousand hides were shipped via steamer from Fort Benton that year. Finally, and with a further touch of irony, steamboats transported the sun-bleached skeletal remains of the buffalo to fertilizer plants and sugar refineries. (Ground and treated, the bones were converted into fertilizer phosphate or rendered into boneblack for use as filters in sugar processing.)

The steamboat era on the upper Missouri and Yellowstone played a significant role in the development of the West, but like many other commercial enterprises, it didn't last long. It was an arrested moment when the West was young. On May 10, 1869, the Golden Spike at Promontory Point, Utah, forged the link between East and West with iron rails, and Montana lost some of its frontier isolation. The locomotive was one predator the steamboat could not elude. The bonanza days of river traffic faded gradually; in 1890, the *F. W. Bachelor* unloaded the last shipment of commercial freight at Fort Benton.

And soon after, it ended.

The steamboats' colors were hauled down and with them disappeared the mournful whistle, colorful captains and boisterous crews, flashing paddles, and the welcome shouts of "Steamboat a'comin'." ■



The first steamboat to travel the Missouri River to Fort Benton was the light draft *Chippewa*, which churned its way up the Missouri in 1860. The *Chippewa* was destroyed by fire in May 1861 (photo: courtesy Montana Historical Society).

Remedies For Left-Behind Mines

Mining in Montana has left many reminders of the past. The historic towns of Bannack, Coolidge, Garnet, and many others owe their heritage to the prospectors who came to this territory over 100 years ago. Red Lodge, Belt, and Sand Coulee were all major coal-producing towns before the advent of the diesel locomotive and hydroelectric power.

However, mining in Montana has also left: polluted surface and ground waters; toxic, barren spoil piles; dangerous unobstructed mine openings and structures, and underground mines sinking under roadways. It is these problems from past mining on which this article will focus.

These mine-related impacts occurred long before the term "reclamation" was ever conceived. In a 1977 report, the Department of State Lands estimated up to 20,000 acres in Montana had been disturbed by historic mining. A 1978 Water Quality Bureau report estimated 100 miles of streams had been affected.

Nationally, impacts of past mining are serious. Within coal fields of the eastern United States, 6,000 miles of stream have been degraded. Land surfaces caving in and mine fires have threatened entire communities. The Soil Conservation Service estimated in 1977 that 1.1 million acres had been disturbed by coal mining operations now abandoned. Environmental degradation and threats to public health from abandoned mine operations prompted congressional action. The 1977 federal Surface Mining Control and Reclamation Act mandated stringent controls over coal mining operations. Title IV of the act established the means to address problems associated with abandoned mines. The Abandoned Mine Land Reclamation (AMLR) fund was authorized by Title IV. The reclamation fund collects fees from active coal mining operations according to the following schedule: 35 cents per ton of surface mined coal; 15 cents per ton of underground mined coal, and 10 cents per ton for mined lignite coal.

Burning a "gob pile"—coal wastes—in Roundup (top photo: Ben Mundie). Acid mine drainage (immediately above) at Sand Coulee Creek near Stockett (photo: Michael Hiel).

The Department of the Interior, Office of Surface Mining, collects these fees. Montana's Abandoned Mine Reclamation Program receives 50% of the AMLR funds generated by coal mining in Montana, currently about $10 million per year. So, the Montana program annually receives about $5 million for reclamation. The remaining 50% is used to fund the national abandoned mine reclamation program.

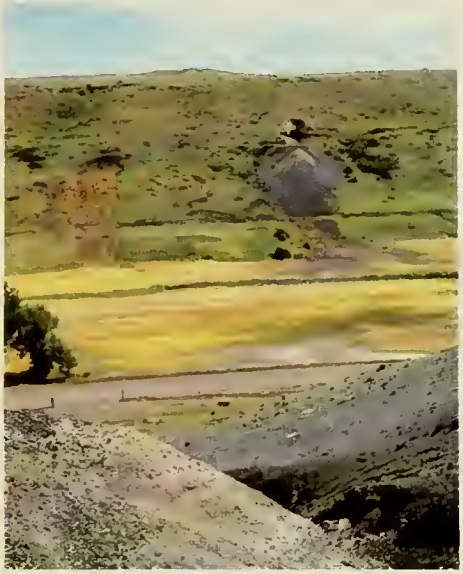
Title IV of the Surface Mining Control and Reclamation Act stipulates lands and waters are eligible for reclamation funds if:

- The area was mined or damaged by mining before Aug. 3, 1977.
- Nobody is responsible for reclaiming the mines or lands under state or federal law.

Since the federal act lists priorities for reclamation planning, priorities were also developed for Montana's abandoned mine reclamation program. The system is based on the observed and reported impacts an abandoned mine site has on the surrounding population and environment. A wide variety of abandoned mine-related problems have been identified in Montana. They include: barren mine waste dumps, unstable mine buildings, unobstructed mine

by Ben Mundie, Richard Juntunen, and Michael Hiel

A sinking coal mine (lower left) on Highway 12 near Miles City (photo: Richard Juntunen). Acid mine discharge at Lulu Pass, near Cooke City (left photo: Ben Mundie). An open adit and loss of productive land near Stockett (below photo: Michael Hiel).



openings, acid mine drainage, destruction of crop lands, unstable explosives, surface sinking, burning coal mines and dumps, and erosion and sedimentation.

Using state, federal agencies, and public meetings as sources for information, a comprehensive inventory of abandoned and inactive mines in Montana was compiled. Over 600 mine sites have been verified in the field and prioritized. These include abandoned and inactive mines—from the Sylvanite Mining District in Lincoln County, to the wind-swept plains of Carter County.

When eligible sites are located, funds will be requested from the Office of Surface Mining to abate and reclaim the mine-related hazards. Landowners will be contacted to assure that the reclamation will meet with their specifications. The Department of State Lands will design an engineering plan for the reclamation project, and actual construction will be put out for competitive bid.

Thousands of unobstructed mine openings, often unmarked, threaten hunters, hikers, skiers, snowmobilers, and other outdoor enthusiasts. Over 100 miles of streams in central and western Montana are adversely impacted by past mining operations. Land surfaces sinking threatens hundreds of acres and anyone crossing them. This is not a reflection on current, regulated mining practices; most of the more serious problems in Montana result from mines abandoned from 40 to 100 years ago.

Since 1980, the Montana Abandoned Mine Reclamation Program has reclaimed 10 "priority one" mine sites. Some of these projects were:

• Stabilizing surface sinking on a county road in Wibaux County. In numerous areas of the state—Culbertson, Miles City, Scobey, Broadus, Red Lodge, and Roundup—roads have been built over mined areas. Engineering has been completed to correct the problems, and construction for the highest priority sites will begin this year. Construction is under way in Scobey to stabilize a collapsing coal mine in a farm complex, and a highway stabilization project outside Miles City on Highway 12 will begin this month.

• Injecting coal waste material back into a mine in Cascade County. A new reclamation technique was used to place the "gob pile" (coal waste) into an existing mine void. Because the process requires no additional disturbance, the possibility of surface sinking is lessened. The mine is then permanently sealed.

• Extinguishing burning coal dumps in Musselshell County. Two projects were completed in and around Roundup. Public health and property were threatened by air pollution and the possibility of fire. One of the dumps caused a 21,000-acre forest fire in 1979. Damage claims from this incident went all the way to the Montana Supreme Court.

• Neutralizing unstable mining explosives in Carbon County. Old dynamite was destroyed near Red Lodge.

• Closing unobstructed mine openings, statewide. Curious people, especially children, are drawn to mine areas, and abandoned mine openings are obviously hazardous. An unstable mine roof can collapse any time, and bad air or gas can be trapped in abandoned underground mines. Recently, a man was overcome by bad air and almost died in an underground mine in Miles City. The Montana program will close or fence the most dangerous mine openings, according to the owner's wishes. This project will be funded yearly for the life of the program.

Mine-related impacts on wildlife and fish are numerous. Surface waters degraded by acid mine wastes not only inhibit aquatic life, but also are usually unfit for human consumption. Fragile habitats near streams are destroyed. Piles of mine wastes result in barren land and reduce the amount of cover for many wild animals. Reclamation goals include cleaning up water pollution and re-establishing a diverse vegetative cover to replace lost wildlife habitat. Every proposed project site is cleared with the Department of Fish, Wildlife and Parks to assure reclamation will not conflict with the needs or habits of rare and

endangered species.

The major impact abandoned mines have on the environment and public health is degraded surface and ground waters. Acid mine drainage occurs when sulphur-bearing minerals (sulphides) are exposed to oxygen and water, often producing sulfuric acid. Mining not only exposes these minerals to air and water, but also provides a direct route for ground water to leave its aquifer.

Acid mine drainage in Montana is not confined to one type of mining or to a geographical area. Hard-rock mining left hundreds of acid-discharging mines in every major mining district in the state.

The Great Falls coal field of central Montana is unique to the western United States. The high sulphur content of the coal mined at Sand Coulee and Belt has created Appalachia-type water problems. From 1885 to 1955, the Great Falls field produced 36 million tons of coal, about 23% of the total state production during this period. Over 120 mine adits penetrated the exposed coal seams. Currently, 10 mines discharge continually at Sand Coulee and three discharge continually at Belt. The total flow of acid discharge from these mines varies from 350 gallons per minute (gpm) to 1,500 gpm, depending on the season and the amount of precipitation, according to a 1982 report prepared by Westech/Hydrometrics. Sand Coulee Creek drains part of the Great Falls coal field and the Sand Coulee mines.

Sand Coulee Creek has no fish from Stockett to the confluence with the Missouri River, 20 miles downstream. Belt Creek receives acid mine drainage from both coal and hard-rock abandoned mine operations. The headwaters of Belt Creek lie in the Little Belt Mountains within the Neihart Mining District. The dry fork of Belt Creek, above Monarch, is without life, except for the hardiest of insects. In the town of Belt, the Anaconda coal mine, responsible for development of the town, now discharges an average of 120 gpm of highly acidic material daily into Belt Creek, according to the Westech/Hydrometrics report.

In Cooke City, Soda Butte Creek runs bright orange below a mill tailings pond, five miles upstream from where the creek enters Yellowstone National Park. Of all the problems found along the entire length of Prickly Pear Creek near Helena, impacts from past mining at the headwaters are most noticeable. Elevated levels of heavy metals and sediment at the mouth of the Prickly Pear at Lake Helena have been traced 30 miles upstream to the Corbin-Wickes Mining District. The upper Clark Fork River from Butte to Milltown has exhibited—and continues to exhibit—signs of mine-related degradation.

An open shaft, 150 feet deep, near Elkhorn (photo: Michael Hiel).

From Libby to Lima, acid mine drainage adversely affects the headwaters of some of Montana's most popular streams. The overall effect of mine-related pollution to Montana's waterways is not easily measured. But when portions of pristine mountain streams are rendered lifeless within their headwaters, a poor precedent is set for the remainder of the stream.

Efforts to control acid mine drainage have not been completely successful in other states, and no easy solutions are apparent in Montana. Reclamation efforts have begun this year to control acid mine drainage using continuous "cropping" techniques similar to those used in saline seep control. With this method, land over the discharging mines is placed into an alternative crop with high water use, like alfalfa, thus decreasing the amount of surface water filtering into the mine, and possibly decreasing the amount of acid mine drainage.

Water will continue to be one of Montana's most valuable resources. With current reclamation laws, the serious problems of past mining should not recur. Since the life of the Abandoned Mine Reclamation Program is one-third over, every available resource must be utilized to protect Montana's people and environment from the impacts of historic mining.

The Montana Abandoned Mine Reclamation Bureau is dedicated to this task and will continue to try to remedy the problems of the past. If you have information about a particular abandoned mine, please call us at the Montana Department of State Lands, 406/449-4560. ■

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Readers Respond

Magazine, Mayflies, and Memories

Enclosed is my three-year renewal to *Montana Outdoors.* Since my first issue was given to me when I purchased an out-of-state fishing license in 1978, I've looked forward to every issue.

I was born in Manhattan and spent my early years in the Gallatin Valley where my dad was a wheat rancher from 1910 until 1930. We lived on the bluff near the current site of the Madison Buffalo Jump State Monument, where we found arrowheads, artifacts, buffalo horns and, occasionally, rattlesnakes.

Some of my fondest memories were of following the spring plow with a coffee can, gathering angleworms so we could take our camping gear and head for Squaw Creek, or Beartrap Canyon, or the Madison River for a fishing trip. The first sighting of the mayfly was also the signal to head for the water. Our "grub box" was always replenished after each trip so it would be ready to go at a moment's notice.

I grew up with a love of the outdoors and the peace it brings when I'm able to get out and enjoy a few days or hours. No matter where I am, my first love is western Montana.

By the way, E.H. "Peck" Bacon—who still holds the state's brown trout record—is my cousin, so it probably runs in the family.

Thank you for refreshing my memories with your magazine. It's truly a work of art, both in articles and in paintings and photographs.—*Mrs. Betty J. Martin; Tumwater, Wash.*

Curlew Pair

I enjoyed the article on the long-billed curlew, "Shorebird of the Prairie," in your May/June 1983 issue. It surprised me when it said the curlew was "possibly threatened with extinction." We have had a pair near here for at least 10 of the last 14 years.

I was very happy to see the hiking guide. Keep up the excellent magazine. — *Larry Harman; Dutton, Mont.*

An End to Badgering

I am writing in regard to your Jan./Feb. 1983 Special Photo Issue. On page 15, I found an excellent picture of a badger. I thought it was such a good picture that I laminated it for future use in my classroom. One of my students fell in love with it, too; so, after several days of "badgering" from him, I gave in. The picture is hanging in his room at home.

Would you have another copy of the badger that I could buy, beg, or steal, so I could use the photo again in the future?

I promise not to give it away, no matter who badgers me for it.—*Renee Corcoran, first grade teacher, Winifred School; Winifred, Mont.*

Useful Article

I want to congratualte you on the excellent article, "Identification of Montana's Upland Game Birds," in the Sept./Oct. 1982 issue of *Montana Outdoors.* I used reprints of the article for my class in our upland game unit. More articles of this type would be welcome in your publication.

Such a piece is invaluable in my sportsman biology course, which I teach in a small town just south of Minneapolis. This is a full-semester course dealing in life histories, identification, field marks, and habitat studies of all large and small game, upland game, and waterfowl of the state. We also have units in orienteering, winter survival, hunter ethics, and much more. As you can see, your upland game article fit in perfectly with this course.

We really appreciate seeing articles like these; keep more of them coming. Ron Jenkins' art was superb as always.—*Don L. MacCarter; Lakeville, Minn.*

Success Story Repeat

This is a success story repeat. Over a year ago ("Readers Respond," *Montana Outdoors,* Jan./Feb. 1982), I wrote you as a proud Oakie, after taking a fine, five-point bull elk on my first Montana hunt.

My second hunt in your state proves my luck still holds: another five-point bull.

Our outfitters did a bang-up job on all counts and made all of us feel very welcome. Three of the four hunters in our party took elk.

The Bob Marshall Wilderness is a beautiful place to hunt. Please don't allow drilling for oil and gas to spoil this area with roads and motorized vehicles.—*Truman Latting; Tulsa, Okla.*

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No Joke

I'm sending $1.25 in the hope of receiving an extra copy of your Jan./Feb. 1983 Special Photo Issue. The photographs were just magnificent! It's enough to make us forget all about the North Dakota jokes you Montana people tell. —*Darwin Bossart; Adrian, N.D.*

Most Informative

I've just finished reading the Sept./Oct. 1982 issue of *Montana Outdoors* from the front cover to the back. I've read numerous state fish and game publications, but I have to say that this publication is one of the most informative and enjoyable I have read.

I have enclosed a gift subscription for my parents in Iowa. I am sure their appreciation for the state of Montana and the treasures it has to offer will only be enhanced by *Montana Outdoors.*—*Arlan C. Quandahl; Billings, Mont.*

Most Interesting Articles

I have several old issues of *Montana Outdoors* that I have gotten from neighbors. The photos are spectacular and the articles are most interesting.

Please bill me for a one-year subscription. This magazine beats all the hunting and fishing books you can buy over the counter.—*Mrs. Marlin S. Brown; Keene, N.D.*

Of Loafing and Fishermen

This particular man who just loved fishing had a wife who insisted he spent more time fishing than working.

He said, "Wait a minute. Take the Bible. Didn't you read the parable of the miracle of the loaves and fishes?"

She said, "So?"

He said, "Well, that's the chapter that proves I'm right. I just love to loaf and fish."—*Ray Bell; Mequon, Wis.*

DRAGGIN' THE DRAGON

by Dennice Scanlon

The thick, weedy growth was packed along the shore, causing our 14-foot Lone Star to jerk as Dad maneuvered it through the southwestern corner of Georgetown Lake, nestled at the edge of Montana's Pintlar Range about 20 miles west of Anadonda. The 9½-horsepower motor grunted against the tangles of floating weeds, sputtered in the clumps of green and brown growth, then finally, with a heavy sigh, gave up the ship.

"They're sure bad this year," Dad muttered, as he tilted back the outboard to pull the stringy mass from the blades.

The comment was more for general effect than for me, but just to let him know I hadn't slipped into a comatose state from boredom, I said, "Yeah, the weeds match the fishing."

He didn't seem to hear me, but I was certain he'd thought the same thing at least a dozen times over that hot July morning. He eased the prop back into the water and gave the starting rope a sharp snap. The motor hummed like an aging opera star and, unfortunately, we were back in business—the business there's no business like—putting on your show for the harshest of critics: the trout who've seen 'em all.

To say the motor was purring as we neared the edge of a dark pocket between two large weed beds would be an exaggeration, but not even a Boeing 707 could have sped us to our destination more quietly. I watched a school of rainbows skitter beneath me as I let the anchor rope slide between my palms and over the side. Dad let down his anchor in the back, so the boat would stay horizontal against the wind that didn't exist. I stared at my reflection on the glassy surface and reviewed the conditions carefully. Temperature: plenty. Water: good. Cover: excellent (for the trout). Wind: zilch. Feed: abundant (freshwater shrimp, caddis, mayfly). Main hatch: damselfly (although not nearly as big or dark in color, locally tagged the dragonfly). And what a dragon it is!

From the time Hartla and Stewart Mill creeks were dammed in the early 1900s, submerging the high meadow below Discovery Basin and providing an excellent source of power for the Anaconda Mining Co., anglers have trekked to these waters, stalking cutthroat and lunker rainbow trout. They have been taken back by the awesome beauty of timeless pines blanketing the nearby peaks and dotting the foothills gently rising from the shores. They have prayed for the cool hatch of caddis on quiet evenings, welcomed the mayfly on breeze-swept mornings, and dreaded the damsel at noon. Driving the fish to churn the mirrored surface to a froth, the hordes of blue and brown flies provide feeding trout with so much of the real thing, they rarely accept an imitation.

So here we sat, Papa Bear and I, on the bright water of Georgetown, fish rising two yards from the boat for the darting damselflies hovering an inch above the surface. Oh, we'd tried matching them. Many Saturday nights found us at the kitchen table, picking grizzly hackles from the sugar bowl, turning the porcelain in Mom's sink blue along with the bucktail and impala, praising each other's creations at midnight, then rising early on a Sunday morning like this one to watch the fish pick off those flies that had landed on our floating lines but snub the ones tied to our leaders.

Thus, we learned the sad truth of the lake fisherman's age-old code: "You damn the damsel. You don't match it."

Laying out a nice, long line to the farthest rise, Dad turned to me. "Have you tried the tan nymph?" He hoped I hadn't.

Sometimes, when fish are feeding on the surface damsels, they hit the nymphs coming up—nymphs we could match.

"It's on now. Have you tried the green?" I hoped he hadn't.

"It's on now." The corners of his mouth drooped.

We were obviously done in. The damselfly nymph, in tan or moss green, remained our last hope. We had tried everything else, now our ace-in-the-hole turned up a deuce. I stripped in my line, opened my fly box, and studied the hairy contents. I could feel the sun popping freckles on my nose as I squinted over the water toward the soaring Goat Flats.

"Why do they call it Goat Flats when it's the highest group of peaks in the range?" I always believe a little conversation on local land formations perks up a slow day.

"I have no idea. What are you trying?"

So much for geology.

"How about this dragonfly imitation we tied up last year, the one with the Lifex tail?"

"I doubt it." He continued to strip in his nymph slowly. "It's never produced much."

Holding up the damsel to the sun, it didn't look like much, I'd have to agree. Tied on a #10 dry, with a peacock hurl body and heavy grizzly hackle backing the blue hackle in front, the long Lifex tail curled up in back like a misplaced appendage. And the color! The blue—too intense. The brown to match the female fly—too deep. My mind drifted back to the cluttered kitchen

table. Across from me, Dad, the light of Edison in his eyes, was holding up something that reminded me of surgical tubing. "This is it," he had chanted. "This is the perfect tail. We'll dye it blue and brown.

I thought of Mom's sink, freshly polished, and, vaguely, of the time the big ones were hitting a black nymph on Harrison Lake north of Ennis. It was unfortunate that our cocker spaniel, Jasper, was black. After a frustrating day on Harrison, my father returned home to his vise, only to find he needed muskrat belly hair dyed black, and Mom was guarding the sink. What is it that drives a man beyond all reason for the feel of a trout at the end of his line? What is it that can turn him on his most devoted, loyal companion. A quick snip, a snarl, and a nip later, it was done. The bite Dad had received from Jasper, however, was the only one the fly produced.

Disregarding past history, I decided to give the rather silly looking dragonfly a whirl. I tied it to the end of my 3× tippet and two feet above the blue one, I attached the brown. Using two flies is a bad habit, one of the many I've held onto, much to my father's disgust. Since the Lifex is heavy and doesn't float well, I used silicone line dressing to keep the flies high and resumed flailing the water to a frenzy.

"Keep your fly on the water. What're you trying to do, create a false hatch?"

Nice to have a comedian in the family during hard times like these. I glanced from my line to my father's profile, peeling in the high, noonday sun, and then plopped my flies on a close rise. The swirl was sudden. Behind it, a violent thrash. I snapped back.

"A double-header," I yelled.

"Take it easy," Dad coached. "One of them is pretty nice fish."

The experts in aquatic gymnastics, the performance of the trout duo was no letdown. The rainbows' twisting leaps and graceful dives were a sight to cherish long after the battle was over. When at last the trout lay side by side in the net, their silver lending color to the softer hue of high, cirrus clouds, I felt a stange surge of power. Had we, the Laurel and Hardy of the fly-tying set, finally solved the case of "The Loch Georgetown Monster?"

"What did you have on?" Dad gently eased the trout back into the tepid water.

"You know. That dragonfly with the Lifex tail." I watched the fish become two streaks disappearing into the jungle of dark weeds below, one of them a good 17 inches.

"I can't figure that. I'd given it up a year ago." He reached for his box to pull a gaudy, blue imitation from the row of "discards" and tied it to his tippet.

The rise to his presentation was as immediate as his cast to the swirl 30 yards to his left.

"I think we've got a winner." As he smiled, his eyes were suddenly as bright as that midsummer sky.

No sooner had he released his spunky catch than my line grew taut again. This had to be an angler's dream. I prayed I'd forgotten to set the alarm. And I must have. For the rest of that morning, until 2 o'clock that afternoon, it was simply a matter of choosing your rise and making your cast. With a slight riffle breaking the even surface at noon, the rises were closer, close enough even for my unpolished arm. Our only problem, minor as it was, became the difficulty in keeping the fly afloat after a fish had taken it under for an unexpected tussle through the weeds.

Greasing the fly with line dressing after landing a 15-inch rainbow, I stopped to examine the fly more closely. We had touched the end of the Lifex with a cigarette to seal it off, then held the lighted cigarette to the middle of the tubing to make it curl upward slightly. As the sun caught the fly just right, the light also struck me. Sure enough! The fly worked because of its transparency—just like the real thing.

"I'm getting tired and hungry," I said, trying to pull Dad's attention away from the fishing.

"It's a little after 2. Maybe we should head in." Was it possible that he, too, had grown weary of so much of a good thing? I laid down my rod next to his in the boat, and he started the motor and turned the bow toward our motor home parked farther west. The campground we had chosen at Finn Bay is one of several on the popular angling and boating lake. The 19 miles of shoreline is conveniently dotted with accesses, boat rentals, lodging, and an abundance of sundries and fishing needs. Since the lake itself is within comfortable driving distance of several cities—like Butte, Anaconda, Philipsburg, and Missoula—it is heavily fished and the trout, bearing the scars of pressure, no longer average what they once did—3 to 5 pounds. It is well and regularly stocked with rainbow and kokanee salmon. There are also some eastern brook trout and grayling which migrate from the creeks that feed the lake. The fish now average from 12 to 18 inches, and a few bigger trout run up to 7 pounds. So if you happen to have "the fly of the moment" as we did, you'll find the fish as plentiful as the overgrowth of weeds.

"Too bad we didn't hook into any big ones like the old days," Dad sighed as the boat neared our campsite.

Did he actually think I'd *had* any "old days?"

I glanced at charred thunderheads forming on the far horizon, knowing nothing could mar the perfection this day had imprinted on my memory, a day that couldn't be matched. On the other hand, maybe it could. After all, didn't we match the unmatchable damsel? Didn't we—one hot, still morning stretching into a long forever-after afternoon—have the dragon by the tail? ■

Contributors

• When Capt. James Cook sailed through the inside passage of British Columbia in the 1700s, he thought the mountain goats he saw were "white bears." Since the polar bear was the only known animal which was large, woolly, and white, it's easy to understand how he could misidentify the mountain goat. Turn to "Delicate Mountain Monarchs" on page 2. As **Gayle Joslin** writes: "Roads and projects creeping into its domain, coupled with the goat's predictable, habitual nature, threaten its continued existence in areas undergoing development." Joslin is a department wildlife biologist and has spent several years studying mountain goats.

• **Jim Peterson** is the department's fish health biologist and, appropriately, his article in this issue covers "Well-Healed Cutthroat." It's a success story. A 1976 inspection at the Yellowstone River Trout Hatchery in Big Timber revealed a potentially hazardous bacteria that causes bacterial kidney disease in hatchery fish. It is one of the diseases most feared by fish culturists. Because of an experiment that worked, the hatchery's cutthroat are now healthy—and a bright future for the Yellowstone cutthroat stocking program is ensured. For the full story, turn to page 6.

• In some lakes into which opossum shrimp have been introduced, declining kokanee salmon populations have resulted. In other lakes, where food has been scarce, the small shrimp has provided a desirable food item for cold water fishes, including kokanee. The shrimp has been found in Flathead Lake and, as the title of **Steve Leathe's** article suggests, "**Shrimp and Salmon in Flathead Lake: Time Will Tell.**" Leathe is a department fisheries biologist working on studies in the Flathead drainage funded by the Environmental Protection Agency and the Bonneville Power Administration. This article (page 8) is an outgrowth of a two-year department fish food habits study conducted on Flathead Lake.

• " 'Fire Canoes' on the Big Muddy" has enabled **Ken Walcheck** to meld two subjects dear to his heart: history, and his long-time involvement with the Missouri River. It's a story replete with sounds, adventure, mosquitoes, a treacherous river, and, most of all, it's "an arrested moment when the West was young." As you read his article, beginning on page 15, he will be on the river: Since 1972, he has been a lecturer in the "floating classroom" on the Missouri sponsored by Northern Montana College.

• Most of the serious problems in Montana related to mining result from mines abandoned from 40 to 100 years ago. Some of these problems include: barren mine waste dumps, unstable mine buildings, unobstructed mine openings, acid mine drainage, land surfaces sinking over abandoned mines, destruction of crop land, unstable explosives, burning coal mines and dumps, and erosion and sedimentation. The Abandoned Mine Reclamation Bureau of the Department of State Lands (DSL) is trying to find some "Remedies for Left-Behind-Mines." For a progress report, turn to page 20. Authors **Ben Mundie** and **Michael Hiel** are reclamation specialists on contract with the DSL to develop an abandoned mine reclamation program; **Richard Juntunen** is chief of DSL's Abandoned Mine Reclamation Bureau.

• It was hot. No wind. No fish. One of those afternoons when you might as well dump the "hairy contents" of your fly box over the side of the boat. But then the homemade dragonfly took off, and a never-to-be-forgotten afternoon began. Turn to "Draggin' the Dragon" on page 24. **Dennice Scanlon**, a fourth grade teacher in Anaconda, is on leave and will earn her M.F.A. at the end of fall quarter from the University of Montana. Her short fiction pieces and poetry have appeared in many other publications.

• When the Bighorn River was officially reopened to fishing on Aug. 20, 1981, anticipation at the prospect of fishing a "virgin" trout stream was incredible. "Many fishermen expected 5- to 20-pound trout to jump into their boats," writes **Wade Fredenberg**. Of course, most did not find the fishing paradise they had expected. Because of unreasonable expectations, some were disappointed. But go to the Bighorn with reasonable expectations, as Fredenberg suggests, and enjoy that beautiful stream's floating and fishing. Fredenberg is a fisheries biologist for the department, working from the Billings office. Turn to page 27 for "On the Bighorn: Reasonable Expectations."

• A rotting log or stump seems an unlikely place to find one of the most extraordinary creatures in nature. This remarkable group of organisms possesses characteristics of both plants and animals. And, this group possesses a name not particularly pleasant to the ear: slime molds. To learn more about these interesting structures, turn to **Steve Stephenson's** article, "Woodland Plant or Woodland Animal?" on page 31. Dr. Stephenson is an associate professor of biology at Fairmount State College in Fairmount, W.V. He finds slime molds fascinating and has been studying them for eight years, including three summers of independent research in Montana.

• "The Heartbeat of History" continues the *Montana Outdoors* series on department lands. This site—Rosebud Battlefield State Monument—marks the largest Army-Indian battle ever fought on the northern plains. It's a special place, where rifle pits, tepee rings, and Indian petroglyphs add to the sense of history. **David G. Conklin's** article begins on page 32. Conklin is the parks manager for the Miles City region.

• "Interpretation" involves many techniques: living history demonstrations, talks, signs, brochures, and exhibits. As **Terry Knupp** writes, "The variety of interpretive techniques used at Montana state parks reflects their diversity, as well as the many different ways of telling their stories." Effective interpretation can help visitors "Strike Gold at Montana's State Parks." Knupp has been with the Parks Division for over three years, working as a planner for the state park system and, most recently, as manager of Spring Meadow Lake State Recreation Area near Helena. Turn to her article on page 36.

• *MO* extends special thanks to **Shirley Cleary** of Helena for her continuing contributions to the magazine. She was the artist for our May/June 1982 front cover. In May of this year, she had a piece selected for the Northwest Watercolor Exhibition in Bellevue, Wash. Her work has also been featured in *American Artist Diary* and *Contemporary Western Artists*. Her primary medium is gouache, an opaque watercolor technique. Her inside front cover painting in this issue is evidence of the technique's effectiveness. Her work can be seen at Tatem House, Helena; Bud Lilly's, West Yellowstone; Wild Wings, Bozeman; Gallery 85, Billings, and Hole in the Wall, Ennis, as well as at several out-of-state galleries.

• *MO* appreciates the contributions of the following photographers: **Harry Engels**, Helena; **Vince Fischer**, Butte; **Gary D. Holmes**, Lolo; **Louis M. Kis**, Kalispell; **Mike Logan**, Helena; **Bill McRae**, Fairfield, and **Allen Wiederrich**, Crane.

On the Bighorn:
Reasonable Expectations

by Wade Fredenberg

"SUPERB." "Magnificent." "Incomparable." These adjectives are used in national publications to describe the trout fishery on Montana's Bighorn River. But is this mountain of media hype justified? Before answering, it is important to examine some of the findings of Montana Department of Fish, Wildlife and Parks' fisheries biologists working on the Bighorn.

This river has become the premier quest of the trout-fishing public across the nation, particularly by those who call themselves fly fishermen. A 500-foot-high concrete barrier—Yellowtail Dam—created the fishery in 1965 from what was once a typical warm-water stream harboring catfish and sauger. Ten years of increasingly productive and popular trout fishing followed. In 1975, the river was declared off limits by the Crow Indian Tribe, through whose land the upper 44 miles of river flow. A legal stalemate developed over the questions of who had access to the Bighorn River and who could partake in the quality trout fishing.

DFWP photo: Bill Pryor

The department closed the river to fishing in March 1978 as the question of river ownership went to the courts. A long trek through the judicial system culminated in a March 24, 1981, decision by the U.S. Supreme Court that the river bed belonged to the state of Montana and not to the Crow Tribe.

During the five months between the court's final decree and the morning of Aug. 20, 1981, when the river was officially reopened to fishing, anticipation at the prospect of fishing a "virgin" trout stream was incredible. Tales of what the river offered ranged from downright optimistic to outright ridiculous. Many fishermen expected 5- to 20-pound trout to jump into their boats. The atmosphere was something akin to what would occur if Yellowstone National Park were to open to general big game hunting on five months' notice.

The Bighorn is a beautiful stream to float, fish, and enjoy. Go there with reasonable expectations, and you won't be disappointed (DFWP photo: Pat Marcuson)

Of course, most anglers did not find the fishing mecca they had expected. Incredible as it seems, some were (and still are) disappointed at catching 2- to 4-pound trout. While fish were occasionally caught in the 5- to 6-pound range, an electrofishing survey conducted by the department during late July and August of 1981 (just before the opening) previewed what the Bighorn really held. Of 1,544 brown trout longer than 8 inches handled (catchables), only 46 (3%) weighed over 4 pounds and the largest weighed 5.36 pounds. Rainbows fared better with 51 of the 230 catchables exceeding 4 pounds (22%), and one 8-pounder was netted. Fishing that first summer was excellent, but it never measured up to what it "used to be"—and therein lies the problem.

Examination of creel census records from 1973 indicated that fishing for trophy trout *never was* as good as it "used to be," so to speak. During the 1973 study, the average length for brown trout measured was 15.2 inches, and about 11.5 inches for rainbows. Immediately after the 1981 opener, department personnel measured 221 browns that averaged 15.3 inches, and 186 rainbows that averaged 16.7 inches. The average length of 1,210 brown trout caught by anglers during the summer of 1982 was 15.8 inches; 1,498 rainbow trout averaged 15 inches.

The largest angler-caught trout documented from the Bighorn River was a 29-inch, 16-pound 2-ounce, rainbow landed in March 1976. This is consistent with results from electrofishing surveys. Most of the truly large trout in the Bighorn are rainbows. The largest known brown trout, caught in 1974, weighed 13 pounds, 8 ounces.

The Bighorn River is a dynamic system both physically and biologically. What was once a heavily braided stream depositing a large silt load in the Bighorn Valley has shifted to a more erosive stream, scouring down through the valley and gathering sediment as it goes. Partially because of this, the river has tended back toward a single main channel. The river has also cleansed the bottom gravels of their fine sediments, producing clean gravel more suitable for trout spawning.

The fish and aquatic life of the Bighorn also continue to evolve. Initially, the river contained very few trout, so stocking programs were started. Rainbow and cutthroat trout stocked as fingerlings grew rapidly to provide fish for anglers. By 1973, the brown trout population had begun to increase through natural reproduction. Less than 20% of the fish harvested in 1973 in the upper 12 miles of the river were brown trout. Today, brown trout provide about 50% of the catch.

Electrofishing in 1981 and 1982 has shown that brown trout in a seven-

mile section of the upper river outnumber rainbows about 6-to-1. The reason that rainbows still make up half of the catch is due to their "differential catchability"—they are easier for fishermen to catch. In a section of the Bighorn 20 miles downstream from Afterbay Dam, browns outnumbered rainbows about 2-to-1 in 1981. Brown trout dominance has developed despite the stocking of over 200,000 rainbows in the upper Bighorn. No brown trout have ever been planted there. The browns were simply better competitors.

The Bighorn is also unique among Montana trout streams due to a couple of other biological quirks. It is probably the only major Montana trout stream without a large population of mountain whitefish. In many other trout waters, whitefish outnumber trout 20-to-1, or more. In the Bighorn, tables are turned, with trout outnumbering whitefish by a ratio nearly that high. The Bighorn offers what should be a hospitable environment for whitefish, and it appears numbers are increasing. Whitefish there grow rapidly, with specimens up to 3½ pounds taken. This is just another indication that the Bighorn fishery is probably still moving toward equilibrium. Some biologists speculate that through predation, the brown trout population may limit the whitefish numbers.

A second highly unusual situation in comparing the Bighorn with other Montana trout streams involves sculpins, conspicuous in the Bighorn by their absence. They were not native to the Bighorn's muddy waters before construction of the dam. Once established, they would probably thrive beneath the cobbles of the upper Bighorn. The silty bottoms of the lower river probably prevent sculpins from migrating upstream from the Yellowstone. So the Bighorn remains without sculpins. In most other brown trout streams, the sculpin is a heavily utilized food source.

During the mid- and late 1970s, when the Bighorn was closed to fishing, the department did not collect fish population information. Since July 1981, biologists have made four population estimates on brown trout in a seven-mile section of the upper 12 miles of river. Results show the brown trout population has remained fairly stable with no indication of excessive harvest. In fact, evidence is beginning to show that a higher brown trout harvest may be desirable. Reproduction in this species has reached high levels, much higher than on most other major trout streams in the state, so there is a possibility of overpopulation. This could mean that eventually the river will support the same total poundage of fish, but it will be distributed among a higher number of smaller fish.

As knowledge grows, department fisheries biologists will be able to employ techniques and establish regulations that will optimize the fishery on the Bighorn.

Department biologists are collecting and analyzing information to see if this is happening. At this time, the growth rate of larger Bighorn River brown trout (longer than about 18 inches) is very low. Monitoring of tagged brown trout has also shown that most grow slowly past about 18 inches. In addition, the larger fish have low condition factors—they are skinny. This may relate to a lack of forage species in the river, such as whitefish and sculpins, because large browns are piscivorous (eating other fish) which enables them to grow to trophy size in most waters.

The rainbow trout population in the river presents an entirely different picture. Despite the heavy stocking of past years, a stable spawning population has not been established. Some natural reproduction occurs, but evidence indicates that at least 50%, and possibly as high as 90%, of the rainbow trout in the river are hatchery fish. Unlike the browns, even large rainbows continue to grow rapidly, and they remain fat and healthy. However, as already mentioned, their vulnerability to angling eliminates them rapidly from the population. While 22% of the catchable rainbows captured by electrofishing before the river's reopening in 1981 weighed over 4 pounds, only about 4% exceeded that 4-pound figure in the December 1981 sample (after four months of fishing pressure).

This brings us to the biologist's predicament: how to manage the Bighorn River for species and size distribution. Nothing brings out the fight in a fisherman like regulations he or she doesn't support. This has been demonstrated on the Bighorn. When the river reopened in August 1981, a so-called "slot limit" was enforced on the upper 12 miles. Anglers could keep three fish, but had to release those between 18 and 22 inches long. This pleased almost nobody, and created a great deal of controversy.

In 1982, the regulation was changed, allowing three fish, with one over 18 inches. In general, this regulation was better accepted, but it has still generated a lot of controversy. Nowhere was this more clearly demonstrated than during the January 1983 meeting of the Fish and Game Commission where regulations were set for the coming year. The commission received about 200 letters from all over the country; 150 of those were concerned with the Bighorn River. In addition, three separate petitions with over 400 total signatures were presented regarding Bighorn River regulations. In general, opinion was about equally divided between those who supported current regulations or wanted them liberalized, and those who pushed for more restrictive regulations. Comments ranged from those who perceived killing of fish as an atrocity somewhere between manslaughter and purse snatching, to those of a toothless older gentleman who claimed he would starve if he couldn't eat trout flesh.

The department cannot please all of the people all of the time. Our foremost obligation is to protect the resource. Regulations currently enforced appear to do that, but there is always room for improvement. As more information is gathered and trends in the fishery become apparent, biologists will recommend adjustments in the regulations. At present, it appears that brown trout may be able to withstand a higher harvest, and larger fish may benefit from reductions in the population with increased growth rates.

On the other hand, rainbow trout might require stricter protection to enhance their potential for natural reproduction and to carry more fish through to the larger size ranges. In

the past, fisheries biologists sometimes have been reluctant to establish species-oriented regulations targeting one species for harvest (brown trout), while protecting a second species (rainbow trout) in a mixed population. This reluctance comes partially from some anglers' inability or unwillingness to differentiate between species. However, hunters are required to know at what animal they are shooting and, with minimal effort, anglers should be able to identify their fish, especially when only two trout species with dissimilar characteristics are involved. A species-specific regulation is being tried this year on the Madison River. If successful, it might be tried elsewhere in mixed-species trout fisheries.

The real controversy over protection of rainbow trout on the Bighorn involves the origin of the fish being protected. Is it sensible to raise rainbows in a hatchery, stock them in a stream with a large population of wild, self-sustaining brown trout, and then protect them from harvest so that catch-and-release fishermen can enjoy a mixed-species bag? Past management philosophy has often been keyed to the concept that hatchery fish are raised to be harvested for maximum return on the dollar spent. The solution to this quandary depends on one's perspective. The angler in eastern Montana who doesn't fish the Bighorn and who lives without a nearby trout fishery, may believe the rainbow planted in the Bighorn could be of greater benefit planted elsewhere. The supply of hatchery fish is limited by capacity as well as cost.

Another controversy that swirls on the Bighorn has to do with bait fishing. Studies indicate that fish hooked on bait swallow the hook; if released, they suffer high mortality. Mortality of fish caught and released on flies and lures is lower. Because of this, the upper 12 miles of the Bighorn—the most heavily fished section of the river—has been closed to bait fishing (with the exception of a short reach immediately downstream from Afterbay Dam). Since results from the creel census station indicate that about 80% of the fish caught are voluntarily released, high mortality of released fish could become a valid concern. However, bait fishermen have rights too, and they argue that fish caught on bait are seldom released. The average bait fisherman, they say, will catch his or her three fish and go home. Who is right?

Biologists have jokingly thought about a regulation called "fry-and-release." It should satisfy everyone. The river would be marked off with mile markers. Odd-numbered miles would be designated "catch-and-release" sections where killing fish would be illegal. Even-numbered miles would be "keep-and-fry," where *releasing* fish would be illegal. There would be something for everyone, except the guy with one leg on each side of the boundary lines where the resource would have to fend for itself.

The department cannot please all of the people all of the time. Our foremost obligation is to protect the resource. Regulations currently enforced on the Bighorn appear to do that, but there is always room for improvement.

Current research on the Bighorn focuses on several areas. Biologists will continue to monitor populations to keep a finger on the river's pulse. Trends will be closely watched and regulations may be adjusted if warranted. The department has begun a research project, in cooperation with the Montana Cooperative Fisheries Research Unit at Montana State University, to try to establish what proportion of the rainbow trout population is a product of natural reproduction. Researchers will also examine the success rate for rainbow spawning that is occurring.

Biologists will introduce different hatchery strains of rainbow trout into the system in an attempt to bolster the wild, spring-spawning population. We will examine food habits, particularly of brown trout, to determine if a food shortage exists for larger fish. We will evaluate possible introduction of a forage species, such as sculpins. A creel census station will be operated into fall 1983 to assess fishing pressure patterns and quantify the rate of harvest. Effects of different flow levels on reproduction, and survival of both brown and rainbow trout will also be examined.

Long-term threats to the Bighorn's tremendous fishery potential center on depletion of water. The possibility of withdrawing Bighorn water upstream in Wyoming for industrial uses, such as coal-slurry pipelines, is a real threat. An annual inspection of Yellowtail Dam in October requires shutting the river down to as little as 10% of its normal flow; in the past, this has created serious fish kills and stranded fish. The department is working with the Bureau of Reclamation (BuRec) to alleviate this problem.

For several years, nitrogen supersaturation has been a problem. Excess nitrogen dissolved in the water causes blisters to form on the fish, with potentially fatal consequences. Afterbay Dam, source of this disease, was modified in October 1982 by the BuRec to correct this problem. Time will tell whether this effort has succeeded. The department applauds the bureau's effort to stem this nitrogen problem and hopes the deflector plates installed at Afterbay Dam do the job.

The Bighorn River is a remarkably productive system. The clear waters carry high nutrient loads which produce abundant aquatic vegetation. This, in turn, provides a home for a tremendous density of invertebrates, the major food source for trout. The system's productivity enables it to maintain the fishery that exists today. Management of the river is in its infancy. As knowledge grows, we will be able to employ techniques and establish regulations that will optimize the fishery. But even then, it is doubtful that the Bighorn will produce the mythical monster trout in incredible numbers about which fishermen talk and biologists dream.

Don't believe everything you read. The Bighorn is a beautiful stream to float, fish, and enjoy. Go there with reasonable expectations, and you won't go home disappointed. As a caller confided to me the other day, "There is only one thing 'for sure' in all of this. In the long run, the river will speak for itself." Let's hope that when that day comes, someone will be listening. ■

Woodland Plant or Woodland Animal?

by Steve Stephenson

A ROTTING LOG or stump seems an unlikely place to find one of nature's most extraordinary creatures. But if one searches carefully—during the summer, especially after rain—almost any woodland in Montana will yield a number of the fruiting parts of a truly remarkable group of organisms, the slime molds.

Slime molds (or Myxomycetes, as biologists call them) may not have a particularly attractive name, but members of the group produce very beautiful fruiting bodies which exhibit incredibly diverse forms and colors. Most are quite small, reaching no more than a millimeter or two in height (.039 to .078 inches).

Although large enough to be seen with the naked eye, one can observe slime molds best with a hand lens or magnifying glass. Only then can their intricate nature be fully appreciated. Fruiting bodies may be in the shape of tiny goblets, globes, plumes, or other shapes more difficult to characterize. Some occur in tightly packed clusters, while others are scattered, or even solitary. Many of the more intricate forms have a spore case held aloft on a delicate stalk, but others are attached directly by their bases (sessile). Whatever form the fruiting body takes, its primary function is to produce the spores by which the slime mold is perpetuated.

Slime molds have long intrigued and perplexed biologists because they possess characteristics of *both* plants and animals. The fruiting bodies and spores produced resemble those of many fungi and similar lower plants. Their other attributes are not usually associated with plants, including the capability for locomotion.

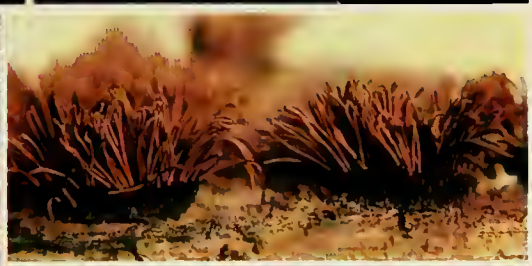
For most of its life, a slime mold exists as a thin, free-living mass of protoplasm with several hundred nuclei. Sometimes this mass is several inches long and—as its name suggests—is actually viscous and slimy to the touch. This mass of protoplasm (a plasmodium) can change form and creep slowly over the ground, much like a giant amoeba. As it moves, it feeds by engulfing bacteria and tiny bits of organic matter, another animal-like feature.

Slime mold plasmodia occur in cool, moist, shady places such as within crevices of rotting wood, beneath decaying bark, and in leaf litter. Consequently, they are not seen as frequently as are the fruiting bodies. However, one can sometimes find plasmodia by stripping the partially decayed bark from a rotten log or by carefully searching the moist undersides of pieces of wood which have been lying on the forest floor. Plasmodia may be colorless or, as is more often the case, strikingly colored—yellow, orange, or red.

After a period of feeding and growth, the plasmodium moves out of its normal habitat and into a drier, more exposed, location. Here it gives rise to one or more of the fruiting bodies. This remarkable transformation—from an animal-like to a plantlike form—seems more like something from science fiction than science fact.

Each fruiting body contains many spores. These are dispersed by the wind and, under suitable conditions, germinate—the first stage in development of a new plasmodium.

A slime mold plasmodium (left) occurs in cool, moist, shady places. The spherical fruiting bodies of *Prototrichia metallica* (above) occur on rotten wood in the Rocky Mountain area.

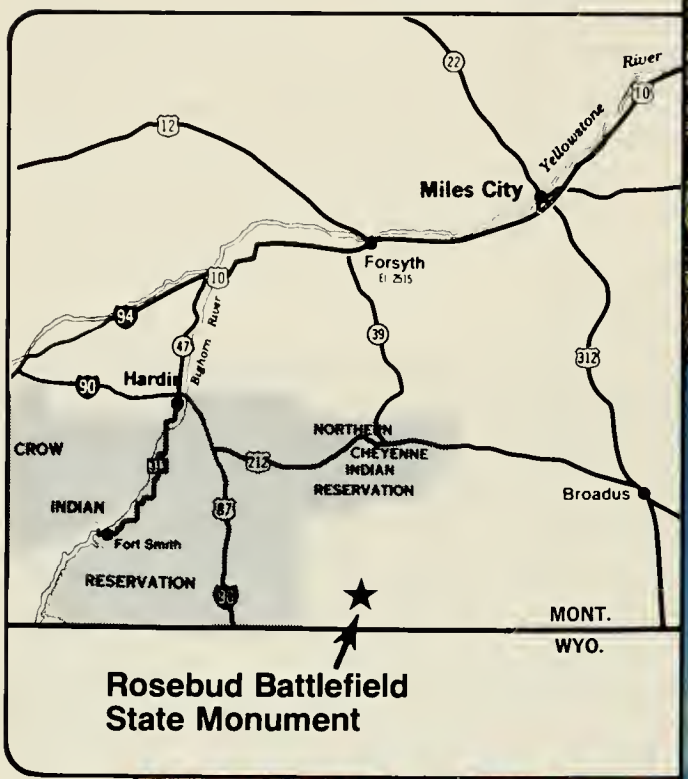


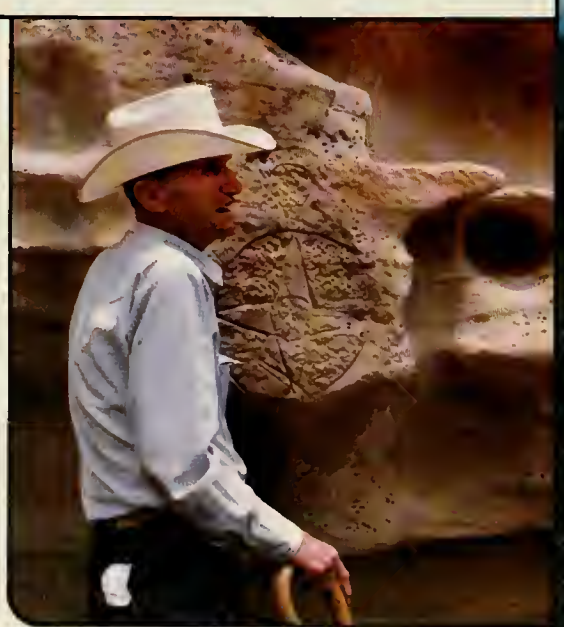
Fuligo septica (left) is one of the largest slime molds, sometimes producing a fruiting body several inches across. The fruiting bodies of *Stemonitis axifera* (above) are slender, cylindrical, or plumelike structures (all photos: Steve Stephenson).

The slime molds constitute a relatively small group of organisms, with only about 500 species known to science. Many species are cosmopolitan, occurring worldwide in forested regions, but some have a more restricted distribution. For example, one group is apparently restricted to alpine regions, and the fruiting bodies are found along the margins of melting snowbanks in spring and early summer.

Most people overlook slime molds, because of their small size and where they occur. However, as anyone who has taken the time to become familiar with the group will undoubtedly attest, they are among the most fascinating inhabitants of Montana's woodlands. ■

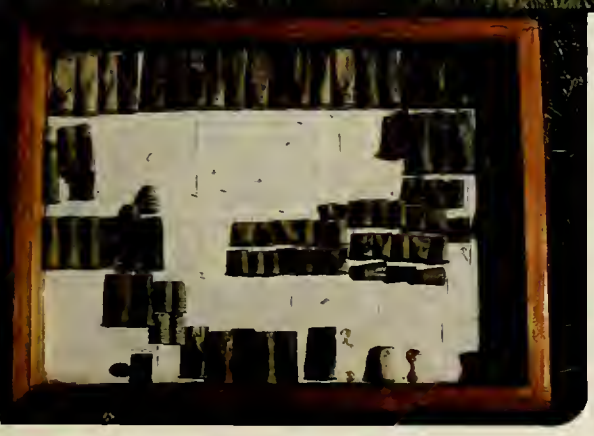
A September walk along Rosebud Creek at the Rosebud Battlefield State Monument is likely to yield some brilliant wild plums (right).





Slim Kobold (above photo: courtesy Bureau of Land Management) looks over some pictographs found at the battlefield. His desire to see his ranch become a historical monument eventually led to state purchase of the site with coal tax revenues.

Chief Two Moons was a leader in the 1876 Rosebud battle, the largest Army-Indian conflict ever fought on the northern plains (left photo: courtesy K.F. Roahen Collection).



The view from Crook's Hill (left), the grassy vistas open to the horseback rider, and Slim Kobold's collection of bullets from the Rosebud Battlefield make the visitor almost able to hear the heartbeat of history.

DEPARTMENT LANDS:
ROSEBUD BATTLEFIELD STATE MONUMENT

The Heartbeat of History

by David G. Conklin

WHEN SLIM KOBOLD homesteaded near Rosebud Creek in 1911, he didn't realize that 35 years earlier—June 17, 1876—his land was the site of the largest Army-Indian battle ever fought on the northern plains. Brig. Gen. George Crook and his mounted strike force of cavalry, infantry, and Indian scouts were attacked and stopped here by thousands of Sioux and Cheyenne warriors. This strategic victory allowed the Indians to successfully defend their village on the Little Bighorn eight days later, from an attack by Lt. Col. George A. Custer.

For years, Slim Kobold fought to preserve this battleground from strip mining. In 1978, his 4,885-acre ranch became the first state monument purchased with funds from Montana's coal tax revenues—and what a monument it is. The remains of rifle pits, homesteads, tepee rings, Indian petroglyphs, a 4,000-year-old buffalo jump, a vision quest site, and the stories told by old Indian warriors all share in making the Rosebud Battlefield a special place where you can actually feel the heartbeat of history.

Management activities at the state monument, between Sheridan, Wyo., and the Custer Battlefield, have so far been limited to historical surveys, weed control, and seeding farmed areas with native grasses. Acquisition of land for an entrance road and visitor facilities, as well as road and visitor center development, must wait until funds become available.

Even though the Rosebud Battlefield is undeveloped, over 5,000 visitors brave the gumbo roads every year to read the interpretive signs at the entrance and to travel the same ground over which Chief Crazy Horse fought in 1876.

Late spring and fall may be the best times to visit the Rosebud. A June horseback ride through a profusion of sweet-smelling wildflowers, with the snow-capped Bighorn Mountains in the distance, is a long-remembered experience. Or a September walk along Rosebud Creek, as sharp-tailed grouse flush from the brilliant red and yellow leaves of wild plum and chokecherry, is sure to sharpen your senses.

Whatever the season, the Rosebud Battlefield is waiting for you *(photos by author, unless otherwise credited).* ■

Where the Deer and the Antelope Play

The American West. Long before the cattle drives and cowpunchers, this was the ancestral home of the pronghorn antelope and mule deer. Originally, populations of both species numbered in the millions.

The rapid settlement of the West was devastating to both these big game animals. By the turn of the century, populations of pronghorn and mule deer had plummeted to a point where the survival of either species was in doubt.

Fortunately, the efforts of our state and federal wildlife agencies began before it was too late. Over the years, they have set aside millions of acres of prime habitat. And live trapping and transplant programs have returned herds to suitable areas. Most all the money for these efforts has come from America's sportsmen.

As a result, the pronghorn and mule deer now exist in abundant numbers throughout much of their historic range. It's been an amazing comeback. And today, for both species, seldom is heard a discouraging word.

For more information write to NSSF at the address below.

NSSF
National Shooting Sports Foundation
1075 Post Road
Riverside, Conn. 06878

Dan Bailey Fishing Day: August 14

• *On June 7, 1983, the Montana Fish and Game Commission passed a resolution designating Aug. 14 as "Dan Bailey Fishing Day Throughout Montana." Dan Bailey, noted Montana fly fisherman and pioneer in fish conservation, died May 23, 1982, in Livingston. The following tribute, reprinted from the December 1982 issue of* Fly Fisherman *magazine, was written by Charles F. Waterman, a long-time friend of Dan Bailey's*—Ed.

DAN BAILEY was a charming fishing companion if you could keep track of him. It was easy in a boat, but he liked to wade.

I lost him the first time we fished together and very nearly got lost myself before I found the road and truck in the fast-fading light of the long-gone sun after crawling through a willow jungle and pulling a guide off my rod. Dan came out of the brush much later, said he always got lost when he went to that place, and that I was right to turn on the lights from a cliff above the canyon.

To Dan, fishing was important. Time wasn't, and hunting for him in the darkness was routine. He wasn't really lost; just didn't care where he was when the trout were moving. He moved fast on streams and even faster in mule deer country.

He preferred backwoods creeks to more famous places, simply because he liked to fish in solitude, and when I followed his directions to choice waters I often found no wader tracks but Dan's. Not that he was secretive. The letters he sent to inquiring fishermen all over the world are now collector's items although no one now sits at the desk from which he sent them. Dan Bailey died last May and his wife, Helen, was gone exactly a month later.

The Baileys were a strangely perfect couple for the business. They'd come from New York where Dan gave up his work as a physics instructor (Brooklyn Polytechnic Institute) to go to Livingston, Mont., where his fly shop grew to an international angling institution, beginning in 1938. Helen Bailey's relaxed entertaining of the world's fly casters, almost as much as Dan's friendly expertise, made it go—to surpass Dan's hopes of success.

"I didn't want it to get big," he said. "I just wanted to go fishing."

Dan was often uncertain as to just who was coming to dinner. Helen's cooking was superb.

Dan landed things like tarpon, snook, and steelhead, grinning around his pipestem, but he was an inland trout fisherman first and always and he threw a long, double-tapered line in the smooth, flowing master's loop. Big rigs and shooting heads worked for him but he said he was an "old-fashioned, small-stream fisherman."

He was small, and I once wrote that at first glance he didn't look like Dan Bailey, but the second look revealed an athletic build with powerful, sloping shoulders and his fast-water wading was so precisely balanced that he amazed younger, bigger men.

Fly fishing was uncomplicated to Dan and advanced entomology, while no mystery, was just another pleasant phase off the main track.

"They come through the door talking Latin now," he said. "Things have changed."

His fishing trips certainly weren't measured in fish and any attractive water was irresistible. With Dan directing, I once drove a station wagon where a pack horse would stumble. Cars, Dan thought, were meant to go from home to fishing, regardless of hazards. This was a place he'd discovered years ago, he said. Fishing was terrible, and as I tried to figure a way back to the road, Dan relighted his pipe and said he couldn't understand it. Never had caught anything there, he said.

In Montana they observed Dan Bailey Day by fishing trout streams as Dan had requested. His son John, partner Red Monical, and Red's wife Louise (who runs the fly-tying department), sit at desks not far from the vacant one.

The "store's" name is still *Dan Bailey's* and will be for a long time.—*Charles F. Waterman*

Strike GOLD at Montana's State Parks

by Terry Knupp

"GOLD! I found some!" A small boy's excited voice pierces the still summer air. He is huddled over a large metal stock-watering trough with six other people, all intently panning for gold. It is a Sunday afternoon in August during "Bannack Days," celebrated annually at a state park that preserves Montana's first territorial capital.

Those who visit during Bannack Days can try their luck at panning for gold. They can also dip candles, learn about quilting as they watch experts construct one, tap their feet to fiddle music, and satisfy their hunger with a buffalo burger cooked in the old Meade Hotel. These experiences immerse one in the excitement, sounds, and smells of gold rush days.

Bannack Days is one way Montana's state parks are interpreted to increase the public's enjoyment of them. Interpretation simply explains things in an interesting, enjoyable way.

Several techniques are used, including living history demonstrations, talks, signs, brochures, and exhibits. The variety of interpretive techniques used at Montana state parks reflects their diversity, as well as the many different ways of telling their stories.

From Prairie Dogs To Early-Day Logging

Many Montana parks preserve a scenic, historical, or scientific resource of the state. Often the most practical method of explaining these resources to visitors is through interpretive signs.

At Greycliff Prairie Dog Town State Monument, between Big Timber and Columbus on I-90, over 40,000 people each year stop to see this highly organized animal social system. Visitors can keep their ears and eyes on the antics of prairie dogs, while also reading signs about alarm calls, burrow chambers, and animals which depend on prairie dog towns for their own existence, like the blackfooted ferret and burrowing owl.

The present-day solitude at Rosebud Battlefield State Monument (see p. 32) contrasts with the gun shots and war cries of the massive battle that took place in June 1876, one

week before the Custer Battle. But the quiet promotes an atmosphere for reflection. Interpretive signs explain the maneuvers of thousands of Sioux and Cheyenne warriors as they mounted their attack on Brig. Gen. George Crook's soldiers. The nature of the Rosebud conflict becomes clearer when the weapons, people, and prior events on both sides are explained. Because the Rosebud Battlefield has been a state monument for only a few years, interpretive projects have just begun and much remains to be done.

Some park sites are set aside because of their historical significance, while others are developed for their recreation resources. At Placid Lake State Recreation Area, boating, camping, swimming, and fishing opportunities are the primary attractions. Recreationists at Placid also can gain an increased appreciation for early-day logging practices in the surrounding Clearwater Valley. Interpretive signs illustrate hardships faced by forest harvesters and the ingenious methods of early Montana logging become more understandable.

Lewis and Clark Caverns

The underground story at Lewis and Clark Caverns State Park began some 300 million years ago. Small organisms and sediments were deposited in the bottom of a shallow inland sea, creating the massive limestone beds now exposed. As geological conditions changed, the caverns and their many beautiful variations developed. Guided tours offered at the park enable visitors to see formations and learn about them. This underground trip takes about two hours, including time for a leisurely walk along the paved trail from the park's visitor center to the cave entrance. During the walk, visitors can rest and read signs interpreting the area's geology.

The park's above-ground scenery includes spectacular cliffs, vistas, and wooded canyons. For those who want to spend more time, a quarter-mile self-guided nature trail beckons. It begins at the upper picnic area between the park entrance and visitor center. A brochure describes native plants and explains how they were used by earlier inhabitants. For instance, the leaves of woolly mullein, which can be seen along the trail, were smoked by Indians and early settlers to relieve lung troubles. The brochure is available at the visitor center or at the trail head.

A film suggesting what to do at the caverns is shown at the information building at the park entrance. Visitors can see another film, "The Making of a Cave," at the visitor center near the cave entrance trail head. During the peak visitor season, park personnel present fireside programs in the campground (no reservations required) near the park's entrance.

Last year, the Department of Fish, Wildlife and Parks prepared a brochure on bats for caverns visitors. It explains how bats live, why they are important in nature, and their part in the caverns ecosystem.

Plenty Coups and Missouri Headwaters

The culture and traditions of the Crow Tribe are presented through the interpretive displays at the Chief Plenty Coups State Monument, south of Billings. This site enables visitors to step back into history and study some unique traditions of the Plains Indians. Audio-visual displays, dioramas, and panels interpret the history and daily routines of the Crows.

Highlights of Plenty Coups' life are also underscored. The last chief of the Crow Tribe, he and his wife deeded their home and land for use by everyone as a "Nation's Park." Chief Plenty Coups State Monument extends the Chief's wish for use by all people. Besides historical displays, the site offers picnicking and limited fishing and hiking.

The multi-faceted history of the geographic point where three mountain rivers merge to create one mighty body of water is told at the Missouri Headwaters State Park. Interpretive displays help park visitors recapture moments from the Lewis and Clark Expedition, Gallatin City, the Ling Ferry, and the fur trapping era. Modern picnicking and camping facilities, as well as fishing and floating, are available.

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Park Guides And Information Brochures

Several brochures can help visitors better enjoy Montana's state parks. Most of them cover the site's significance and present guidelines for safe and considerate public use. The Makoshika State Park brochure touches on badlands geology and history, suggests what to look for at the park, and lists the facilities, such as picnic tables and drinking water.

The "Missouri River Guide from Holter Lake to Great Falls" provides a recreation map for floaters and those traveling on the Missouri Recreation Road. Besides illustrating what facilities are available at the individual recreation sites along the river, the brochure discusses river speed, fishing, and scenery. It also reminds recreationists of use regulations. Similar brochures are also available for the Blackfoot, Smith, and Yellowstone rivers.

Educating visitors about park regulations is not easy—few people want to read about what they are *not* supposed to do while camping. To protect park resources and maintain a safe and enjoyable environment, guidelines must exist. Use regulations for Montana's state parks are presented in a fun-to-read and easy-to-understand cartoon brochure. A humorous sketch of a campground where everyone is breaking the rules make clear why use regulations are necessary.

The Future

There are many ways to tell stories and present information. As the need arises, interpretive techniques at Montana's growing state park system will be modified. Audio-visual media, such as slide shows, video tapes, and computer terminals, will probably be used in the future at some of the more heavily visited park sites. Parks personnel will also try to provide more "living history" experiences like Bannack Days.

Well-done interpretation stirs the desire to learn or to know more, and it is one way the state park system enriches the lives of many people. You can strike it rich with a visit to one of Montana's state parks. ■